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THE UNIVERSITY OF ALBERTA

SOME SYNTACTIC DETERMINANTS OF SENTENCE NATURALNESS

BY

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Some Syntactic Determinants of Sentence Naturalness submitted by Bong-Hee Choi in partial fulfilment of the requirements for the degree of Master of Science in Psycholinguistics.

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ABSTRACT

There has been an apparent incompatibility among the experimental results concerning the homogeneity of the three types of the CLEFT constructions (cleft, pseudocleft, and reverse pseudocleft) as a family. A close examination revealed that the incompatibility is due to difference in experimental procedures; that different types of sentences are viewed either as a homogeneous family or as heterogeneous constructions depending on subjects' strategies or attention.

In this study, it was assumed that there are syntactic properties which may only function at an initial parsing and which no longer play a role at a deeper level of processing. These syntactic properties were considered as determinants of sentence naturalness. It was hypothesized that different CLEFT types are considered as heterogeneous when they are looked at from the viewpoint of naturalness.

Experiments were designed to test this hypothesis and to establish a set of syntactic determinants of sentence naturalness. The results indicated that heterogeneity is a function of differential naturalness associated with the various types of the CLEFT constructions. A syntactic analysis was carried out in terms of surface generalizations

to yield a set of five determinants of naturalness. A multiple regression analysis was run on these predictors to obtain the best fitting prediction equation for naturalness with a differential weight assigned to each predictor. Finally a speculative discussion of implications for perceptual strategies related to each of the predictors was presented along with a suggestion for a further study.

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CHAPTER ONE

INTRODUCTION

The so-called CLEFT constructions in English have long been an object of formal and experimental studies by virtue of having interesting structural and communicative characteristics. As early as 1909, Jespersen (1909) wrote that sentences such as (1) are directly derived from a simple sentence such as (2) by means of a discontinuous 'cleaving operator' of the form 'it is ..... WH'.

(1) It is the wife who decides.
(2) The wife decides.

A general term, CLEFT family, has been developed from Jespersen's use of the word 'cleaving' to refer to the three different types of constructions which consist of an embedded clause similar to a headless relative clause, the copula, and a predicate called a clefted constituent. The three CLEFT types are exemplified in (3) - (5) and are generally referred to as cleft, pseudocleft, and reverse pseudocleft respectively.

(3) It was John who kicked Mary.

(4) The one who kicked Mary was John.

(5) John was the one who kicked Mary.

Various formal descriptions of the CLEFT constructions have been proposed in the framework of transformational generative grammar (Chomsky, 1970; Moore, 1967; Bach & Peters, 1968; Akmajian, 1970; Harries, 1973; Higgins, 1973; Nakada, 1973; Culicover, 1977; Gundel, 1977). Though the descriptions differ considerably in actual content and in alleged supporting arguments (discussed in Chapter Two in detail), they share one important characteristic in common -- namely that the different CLEFT types are derived from the same underlying structure. It might be inferred that the assumption underlying this is that the three CLEFT types are semantically equivalent. This will be referred to as the assumption of homogeneity.

In the area of experimental psycholinguistics, there have been some attempts to test the assumption of the homogeneity of the class and to clarify the nature of that homogeneity. In one experiment, Hornby (1971) investigated subjects' performance involving the storage and retrieval of the information conveyed by different types of CLEFT constructions. He demonstrated that the three types of CLEFT constructions are in fact treated equivalently by subjects at a level of the output of the processes of

storage plus retrieval of the information, and thus provided some support for the assumption of homogeneity of the CLEFT family.

In other experiments (Fletcher, 1973; Millar, 1976), on the other hand, it was found that the pseudocleft type is treated differently from the cleft and the reverse pseudocleft by the subjects. The pseudocleft was considered to be significantly less appropriate as an answer to WH-questions, at least by a substantially large subgroup of subjects in Fletcher's experiment. In Millar's experiment, the pseudocleft was judged, by a large subgroup of subjects, to be less similar to the corresponding contrastively-stressed sentence which has a stress on the NP that is the clefted element in the CLEFT constructions. These two experiments showed that the three CLEFT types are not completely homogeneous and that they are, in fact, differentiated by the subjects in terms of some unknown dimension.

In passing, it might be noted that the presence of different subgroups in the pool of experimental subjects should not be taken to be an indication that each subgroup has internalized a different grammar of English. It is reasonable to suppose that any speaker of English, given proper directions, can actually become sensitive to the dimension to which only one subgroup happened to be

sensitive in the two experiments. Therefore, the problem of determining such a dimension is within the realm of study of the whole population of the native speakers of a language but not in the area of the study of individual differences.

A close examination of the experimental procedures used in the studies described above is needed to provide a clue to the nature of the dimension underlying the differentiation. In Hornby's (1971) experiment where the subjects were tested after a delay of 60 seconds, which is known to be long enough for syntactic characteristics of sentences to be forgotten (Sachs, 1974), subjects' performance must have been based on a dimension in which the three types of CLEFT constructions were homogeneous and not differentiated. In the experiments where the subjects had access to the syntactic characteristics of the stimuli at the time of response, the results showed the heterogeneity of the CLEFT types. Therefore, it is argued that the heterogeneity is due to the syntactic characteristics which are irrelevant to the semantic interpretations of the sentences but do influence the initial parsing processes.

Motivated by the abundance of previous studies and the apparent incompatibility in their claims, the present experiments were designed with two purposes. One is to untangle, from the viewpoint of naturalness, the apparent

contradiction between the formal characterization of the CLEFT constructions as a homogeneous family supported by one experiment and the other experimental results revealing the heterogeneity. The other is to establish a set of syntactic determinants of the naturalness of the CLEFT constructions.

In Chapter Two and Chapter Three, various formal and experimental studies of the CLEFT constructions will be reviewed to highlight the problematic issue of homogeneity of the CLEFT family. At the end of Chapter Three, a speculation will be made concerning the source of the apparent contradiction. It will be claimed that there is no real contradiction and that the incompatibility of the experimental results is due to subjects' sensitivity to different kinds of syntactic properties: one kind which contributes to the semantic interpretation of the sentence, and the other which serves no semantic function but facilitates or complicates an initial parsing processes. It will be assumed that the latter kind of syntactic property constitutes a quantifiable naturalness dimension. Naturalness is defined operationally as the property of a sentence which determines the subjects' readiness to produce the sentence and the ease or difficulty involved in its comprehension given an appropriate situation. A null hypothesis is formulated stating that there is no difference in naturalness judgments associated with the three CLEFT

types.

The null hypothesis is tested and the naturalness judgment data are collected in Experiment I, reported in Chapter Four. It is expected that the naturalness associated with pseudocleft is lower than that associated with cleft or reverse pseudocleft. If this is the case, it can be argued that a naturalness dimension accounts for otherwise unexplained differences among CLEFT types. A set of syntactic determinants and the prediction equation of the naturalness will be established through surface syntactic analysis in conjunction with a multiple regression analysis. In Chapter Five, a speculative discussion of implications for perceptual strategies associated with each of the syntactic determinants of the naturalness will be attempted.

CHAPTER TWO

FORMAL DESCRIPTIONS OF THE CLEFT FAMILY

The CLEFT construction is of interest to grammarians since the three CLEFT types share some important functional and structural characteristics and since their sentential structures are complicated enough to be challenged with many different analyses. But it has also been a source of frustration to formal grammarians since it is difficult to find independent syntactic justifications which support one analysis over all the others.

This chapter is devoted to a review of various formal descriptions of the CLEFT structures. There are two major sections in this chapter; one concerns generally agreed upon arguments for grouping the three syntactic types as one family, while the other addresses the actual analyses and alleged supporting arguments where there has been no consensus among the grammarians.

Common Properties of CLEFT Constructions

The terms "pseudocleft" and "reverse pseudocleft" must have been coined within the school of transformational generative grammar with the strong implication that they are related to what has been known as the "cleft" construction. A further assumption is that these three structures are related to one another either directly or transitionally and thus constitute one sentence family.

There are common properties of the CLEFT constructions which support the use of these terms and more importantly the incorporation of all the three CLEFT types as homogeneous members of one family. In particular, the three structures all

(1) have the same communicative function;
(2) mark syntactically the distinction between given and new information.

Same Communicative Function

This characteristic can be restated more precisely in terms of identical presupposition and identical assertions (Harries; 1972). Consider sentences (3) - (6):

(3) It was the GIRL who drank the wine.

(4) The one who drank the wine was the GIRL.

(5) The GIRL was the one who drank the wine.

(6) Who drank the wine?

Sentences (3) - (5) may be regarded as appropriate answers to (6) which is a question (Fletcher, 1973). When a person utters this question he knows readily that somebody drank the wine and asks for an information as to the identity of the drinker. (3) - (5) provide this information. The fact that the underlined part of the sentences (3) - (5) can be omitted or reduced to some sort of a pronoun as in (7) - (8) leads us to think that this part of the sentences does not play an important role in increasing the information.

(7) It was the GIRL. (by reducing the underlined part in (4) to an anaphoric pronoun, it)

(8) The GIRL. (by omitting the presupposition)

Wh-questions are used when the new information needs to be associated with the presupposed information. Since (3) - (5) are appropriate answers providing the required new information, they can be viewed as functionally equivalent.

Thus it is reasonable to suggest that the sentence types such as (3) - (5) each contain a slot for the

presupposed information and a slot for the newly asserted information. When these slots are filled with proper informations in a given communicative context, the sentences will convey the same information, and can therefore be said to serve the same communicative function.

Syntactic Marking

As an answer to (6), (9) is as appropriate as (3) - (5):

(9) The 'GIRL drank the wine.
(with a contrastive stress on 'girl')

However, (9) is distinguished from (3) - (5) by having only a phonological means to mark the distinction between the presupposed and the new informations while (3) - (5) employ syntactic devices for this purpose, and these three types involve two clauses each, while (9) involves only one clause. Therefore, even though (3) - (5) and (9) have the same communicative function, there is a syntactic reason for not including (9) in the same family as (3) - (5).

Furthermore, in (3) - (5) the presupposed information (or the place holder for this) on the one hand and the new information on the other hand are juxtaposed with the copula, "be", in between. The structures associated with

(3) - (5) are listed in (3') - (5') where NEW (syntactically an NP) refers to new information, and PRESUP refers to presupposed information (syntactically a clause):

(3') It be NEW - PRESUP.
(4') PRESUP be NEW.
(5') NEW be PRESUP.

In addition, CLEFT constructions are copula constructions, all showing the same agreement pattern: The clefted noun and the verb in the clause agree in number but not in person. The verb is systematically third person (Akmajian, 1970). This seems to be quite natural in cases of pseudocleft and reverse pseudocleft where there is a third person pronoun preceeding the clause similar to a relative clause as in (10) - (15):

(10) The one who <u>is</u> responsible is me.
(11) The one who <u>is</u> responsible is you.
(12) The ones who <u>are</u> responsible are us.
(13) I am the one who <u>is</u> responsible.
(14) You are the one who <u>is</u> responsible.
(15) We are the ones who <u>are</u> responsible.

But it is not easy to see why the agreement pattern also appears in the cleft as in (16) - (19):

(16) It is me who is responsible.

(17) It is us who are responsible.

(18) It is you who is responsible.

(19) It is you who are responsible.

Akmajian argues that the agreement pattern in the cleft can only be explained by relating it to pseudocleft and reverse pseudocleft where there is a certain syntactic reason for this kind of agreement.

Descriptions of CLEFT Constructions

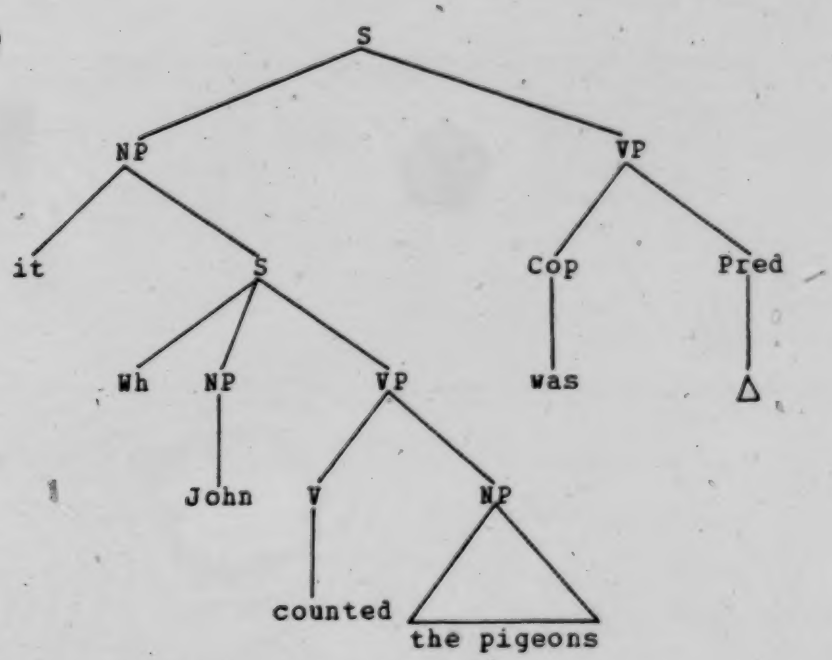
Transformational generative grammarians have formulated various descriptions of the CLEFT constructions. These descriptions will be reviewed in five separate sections according to the deep structure characteristics postulated as the basis for deriving the CLEFT constructions. While the analyses differ from each other considerably in their detailed formulations and supporting arguments, the common characteristic is that they all adopt deep structure very similar to the pseudocleft. The reason for this is obvious: The extraposition transformation, which moves a subordinate clause to the end of a sentence, (Jacobs and Rosenbaum, 1968), and the flipping transformation, which

permutes the NP and the predicate around the copula, (Lakoff, 1970) are already available ("independently motivated") in the grammar. It is easy to see that cleft can be derived from this kind of deep structure by applying the extraposition transformation and reverse pseudocleft by invoking the flipping transformation.

Extracting Analysis

Chomsky (1970, p.209) suggested that the pseudocleft is derived from a base structure of the form (20) where he included the base P-marker of the corresponding unclefted simple sentence and a dummy predicate.

(20)



A substitution transformation replaces this dummy predicate of (20) by one of the major constituents of the embedded sentence leaving a PRO-form in its original position. And relativization and other low level rules will yield a pseudocleft (21):

(21) What John counted was the pigeons.

The label "extracting analysis" associated with this approach comes from the transformation that extracts the clefted NP from its position in the unclefted sentences (Nakada, 1973).

This analysis has a serious defect, namely that it assigns the same deep structure to the non-synonymous sentences such as (22) - (24):

(22) What John counted was the pigeons.
(23) The one who counted the pigeons was John.
(24) What John did was to count the pigeons.

However, this point is not considered as a drawback at all from the viewpoint of the Extended Standard Theory (EST) (Chomsky, 1970; 1972) within which this analysis was done. One of the assumptions of the EST is that

> semantic interpretation is held to be determined by the pair (ds, ss) of Σ, rather than by the deep structure alone; ... Such matters as scope of "logical elements" and quantifiers, coreference, focus and certain kind of presupposition, and certain other properties, are determined by rules that take surface structure into account. (Chomsky, 1972, p.134)

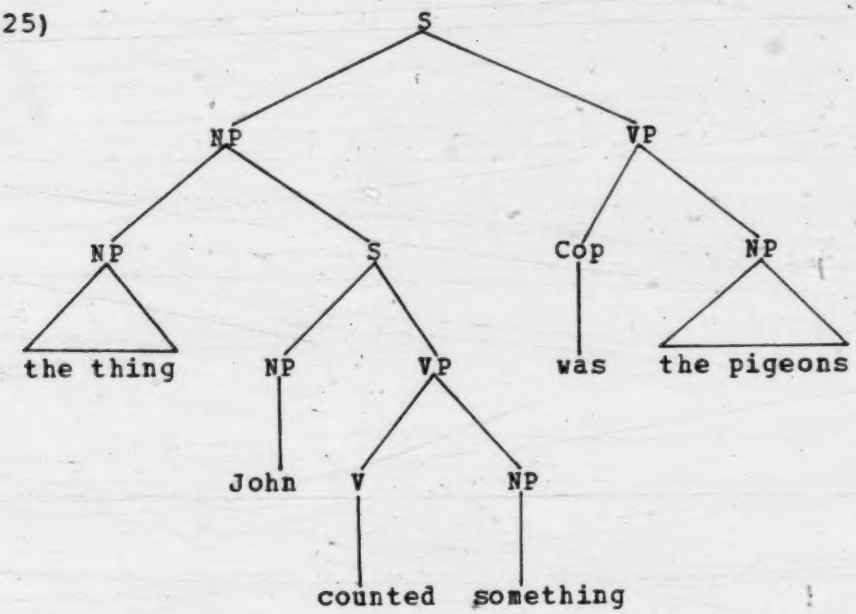
The extracting analysis is a natural outcome of this theory and the different semantic interpretations of (22) - (24) are determined by the two syntactic pairs: same deep structure but different surface structure. The different presuppositions are represented only at the surface. Therefore, any arguments for or against this analysis of the CLEFT construction will be reduced to the debate about the theory of a grammar in general. Since this problem is not a direct concern of this thesis, the evaluation of this analysis will be left open here.

The Underlying Clefted-NP Analysis

The majority of the CLEFT construction analyses are variants of what can be called the "underlying clefted-NP analyses", so long as minor differences are ignored (Lees, 1963; Moore, 1967; Akmajian, 1970; Higgins, 1973; Harries, 1973; Gundel, 1977). In this analysis, the deep structure of the CLEFT construction is also very similar to the surface structure of the pseudocleft construction, but which

constituent of the embedded sentence is to be clefted is determined in the deep structure. For example, the deep structure of (22) can be specified as (25):

(25)



It is usually claimed that this analysis has overcome the difficulty of the extracting analysis by assigning a distinctive place to the clefted-NP in the deep structure. However, as Bach and Peters (1968) pointed out, this analysis commits itself to the exceptional treatment of a reflexive pronoun in the case of the CLEFT construction. According to this analysis, the deep structure of (26) should have a reflexive pronoun, because "missile" and "itself" are supposed to be dominated by different sentence nodes.

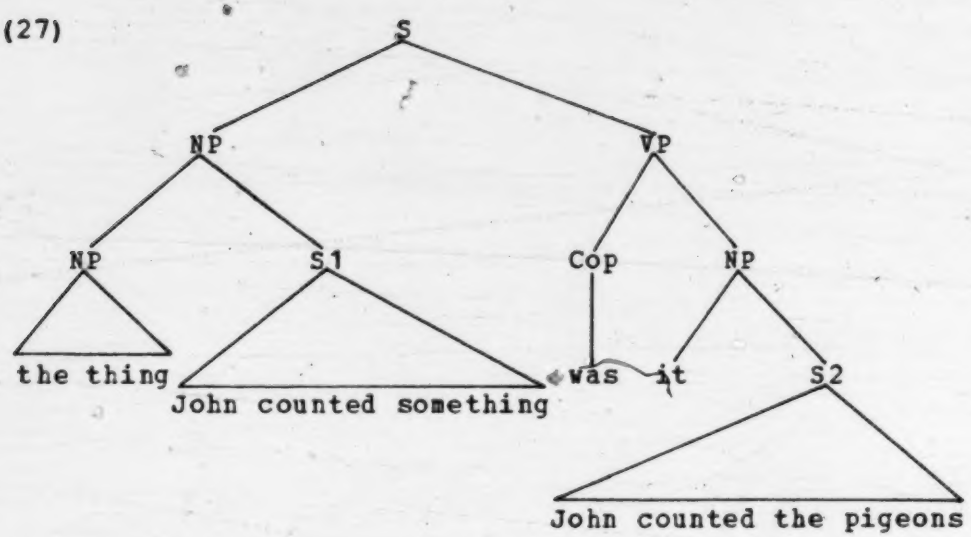
(26) What the missile damaged was itself.

The clause-mate restriction in reflexivization (Postal, 1971, p.65) is a very general condition, providing a constraint on the domain where reflexivization occurs. Clause-mates are defined as those sets of coreferential NP's, neither of which is dominated by an S which does not dominate the other(s), and reflexivization can operate only on clause-mates. In the "underlying clefted NP analysis", reflexive pronouns have to be generated by base rules instead of being generated by applying the reflexivization transformation. This is a significant deviation from the general source of reflexives, and even though it does not necessarily constitute grounds for the rejection of the given analysis, it is totally undesirable in that the otherwise general rule of reflexivization should have to be revised in order to validate this analysis.

Bisentential Analysis

The label "bisentential analysis" was given to Bach and Peters (1968) analysis by Nakada (1973). Bach and Peters posited two nearly identical sentences in their deep structure for a pseudocleft such as (27):

(27)



In this deep structure, the distinction of given (or presupposed) information and new information is implicitly being utilized. The presupposed information is represented by those items which S1 and S2 have in common, in case of (27), "John PAST count something". The common items in S2 are later deleted by a sluicing (Ross, 1969) transformation and the remaining will yield the pseudocleft with appropriate low-level transformations. The analysis proposed by Muraki (1970) is along the same lines. The only difference is that he incorporates and assigns a distinctive place to the higher predicate, PRESP, dominating the NP which itself dominates S, in the deep structure.

Green (1971) and Morgan (1972) claimed that this analysis as well as the other two previously examined

analyses do not seem to be viable as long as the sentences (28) - (30) are grammatical and corresponding unclefted sentences (31) - (33) are ungrammatical.

(28) What I like about John is his sense of humor.

(29) What I see in him is his excellent mind.

(30) What I did to him was kick him.

(31) *I like his sense of humor about John.

(32) *I see his excellent mind in him.

(33) *I did kick him to him.

According to this analysis, phrase markers for (31) - (33) are supposed to appear under the S2 node. However, since these sentences are ungrammatical, there is no way to generate the deep structure including the P-marker of the sentences as part of it. Green and Morgan take the position that a grammatical surface form should not be generated from an ungrammatical underlying form. But there seems to be a sufficient reason to allow the derivation of a grammatical surface form from an underlying ungrammatical form to a certain extent, because such surface forms such as (31) - (33) are marginal cases where some lower level transformations happened to have become obligatory in a language. For example, as is shown in (34) - (35), the adjective "left" is a member of a small group of the adjectives which can not appear in a predicate position and may not take an intensifier, while "skillful" in (36) and

(37) is one of the majority of adjectives which can appear in a predicate position as well as in a pre-noun position.

(34) *My hand which is left is hurt.

(35) My left hand is hurt.

(36) My hand which is skillful is hurt.

(37) My skillful hand is hurt.

Therefore, Green's and Morgan's alleged counter-examples (28) - (33) do not really constitute an argument against bisentential analysis.

Embedded Question Analysis

Nakada (1973) hypothesized that pseudoclefts are an embodiment of a self-generated question and an answer to that question. Nakada presented three arguments for supporting this hypothesis. The first argument is that the intonation of the clause in the pseudocleft is the same as that of the echoed question such as (39), which is different from that of (38):

(38) What did John count?

(39) What did John count? He counted the pigeons.

Even though the form of the first sentence in (39) is a Wh-

question which is normally pronounced with a falling intonation, it ends with a rising intonation since it echoes the previous question (38). This rising intonation is similar to that of the clause in the pseudocleft such as (40):

(40) What John counted ↗ was the pigeons.

Secondly, Nakada noted that the Wh-question and the embedded clause in the pseudocleft share the same presupposition. He argued that a Wh-question presupposes a definite answer to the relevant yes-no question in order for it to be "felicitous" in Austin's sense (Austin, 1963). Nakada claimed that yes-no questions are "prior" as compared with Wh-questions in the sense that some action or state asserted in a yes-no question and its answer should be presupposed in order to ask Wh-questions. For example, the discourse in (41) is ill-formed, or at least very odd, while the discourse in (42) is well-formed:

(41) When is John going to sell his car?
On November 15.
Is John going to sell his car?
Yes, he is.

(42) Is John going to sell his car?
Yes, he is.
When is he going to sell his car?
On November 15.

Nakada argues that sentence (43) is ill-formed for the same reason as discourse (41) is ill-formed:

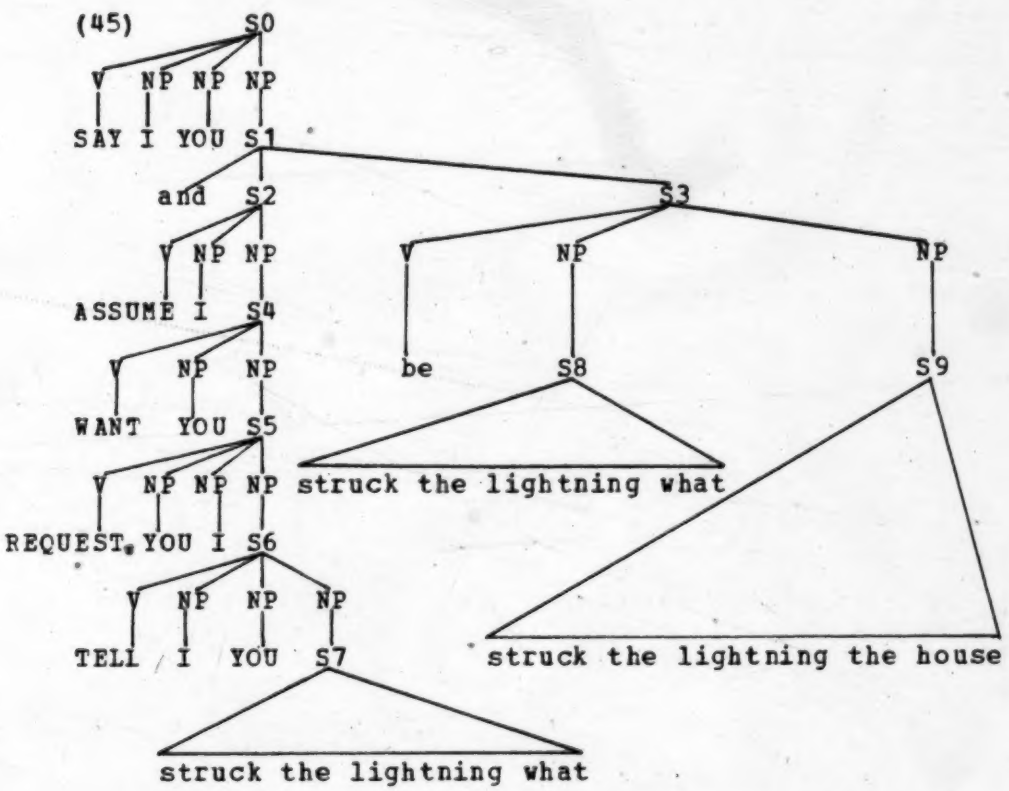
(43) What John counted was the pigeons, but he did not count anything.

Nakada suggested that the same presupposition is a necessary condition for a "happy" Wh-question and that this question should be embodied in the deep structure of the pseudocleft in order to explain the presupposition contained in the pseudocleft.

Thirdly, Nakada argued that the proposed hypothesis receives support from the existence of sentences such as (44):

(44) The answer to the question "What did the lightning strike?" is "the house".

Nakada attempted a detailed formulation of the deep structure such as (45) which will be transformed into a surface pseudocleft through deletion of higher predicates (eliminating performatives), sluicing (deleting equi-constituents), and some low level transformations irrelevant to our discussion (which order subjects and verbs linearly).



Nakada claimed that the deep structure of the pseudocleft was formulated in that way so that it can explain certain other phenomena. Firstly, the deep structure is claimed to be able to explain why the predicate <u>be</u> is always singular in the pseudocleft sentences. The subject of <u>be</u> in S3 is a sentential NP which dictates that <u>be</u> should be singular. The second observation has to do with the tense of <u>be</u>. The fact that the semantic time associated with the tense of <u>be</u> must follow that of the predicate of the clause in the pseudocleft reflects the logical sequence in which the act of questioning must precede the act of answering. Since the question - answer pair exists in the deep structure, the

tense of be can be constrained by comparing it with the tense of the predicate in the question. Thirdly, the postulation of ASSUME as one of the higher predicates is said to be motivated by the observation that sentences (46) - (47) can be used without necessarily knowing the hearer's opinion or intention:

(46) What's interesting about linguistics is its preoccupation with turtles.

(47) What you are going to talk about is the relevance of turtles to linguistic theory. Right?

It is not asserted in these sentences that the hearer is interested in linguistics or that the speaker knows what the hearer is going to talk about. It is rather that the speaker assumes a certain state of the hearer's mind. Finally, Nakada claimed that he could circumvent the problem of the non-existence of unclefted versions such as (31) - (33), by taking the question to be an integral part of the deep structure of the pseudocleft. In Nakada's analysis as in (45), presupposition exists in the question S2, but not in the answer S3 and the answer to that question does not contain all the information of the S2 but just a subset of it, plus new information. Consequently S3 , which takes the form of a grammatical surface form, is generated in the deep structure. As in bisentential analysis, the problem still remains as to whether one should allow hypothetical

sentential structure in the deep structure which is not a subset of grammatical surface forms or whether one should expand the PS rules. It is conceivable that one could generate underlying strings such as (34) in parallel to (36) and generate (35) by applying the relative clause reduction and front-shifting transformations obligatorily, rather than expanding the PS rules to permit a rule which generates an adjective as a daughter node of an NP. Since the deep structure is an abstract hypothetical underlying form of a surface structure, there seems to be no formal reason to insist that the deep structure should be identical to one of the permissible surface forms.

Apposition Analysis

Culicover (1977) claimed that the input structure for the derivation of the pseudocleft involves an appositive in the subject and a dummy NP complement to the copula be:

(48) [[What John counted] [the pigeons]] was [Δ].
(49) [[What John did] [to bake a cake]] was [Δ].

Culicover argues that this kind of deep structure permits us to account for the fact that constituents which may normally appear as complements of be in the deep structure (i.e., NP, AP) may give rise to ambiguous pseudoclefts such as (50),

while constituents which can not be complements of be (i.e., S, VP) give rise to unambiguous pseudoclefts such as (51):

(50) What Henry whispered to Nancy is a military secret.

(51) What John did was to bake a cake.

Consequently, Culicover's analysis tells us that only one of the two readings of the pseudocleft can be the proper reading of a pseudocleft as focusing construction and as a synonym of the corresponding cleft and reverse pseudocleft. For instance, (50) is ambiguous in two ways as we can see in (52) and (53), and only one of the the readings as expressed in (52) is synonymous to that of (54) and (55) (Gundel, 1977):

(52) What Henry whispered to Nancy is a military secret, which is about the number of soldiers to be sent to the area.

(53) What Henry whispered to Nancy is a military secret, but I think he only asked her to dance.

(54) It is a military secret that Henry whispered to Nancy.

(55) A military secret is what Henry whispered to Nancy.

To conclude this chapter, it will be useful to note that each of the underlying structures thus far examined, whatever form it takes, is the base for deriving all three types of CLEFT. This point may be somewhat obscure in the analyses reviewed, but one of the most important theses of transformational generative grammar actually prescribes this, namely, that synonymous sentences are assigned the same deep structure.

Harries (1973) made it explicit that his deep structure for the CLEFT construction is the source for the derivation of all sentences that contain a contrastively stressed (phonetically or syntactically) constituent. In a word, grammarians have struggled to find an underlying structure for all the variations of the CLEFT construction considering them as superficial variants of a homogeneous class. In the next chapter, the experimental studies dealing with the CLEFT family will be reviewed with special attention to the implication for the question of homogeneity of the family.

CHAPTER THREE

EXPERIMENTAL TREATMENTS OF THE CLEFT FAMILY

Experimental psycholinguistic studies of the CLEFT construction which are relevant to the present study were stimulated by two different perspectives. One was an interest in testing the hypothesis about the form or status of the stored structure of perceived sentences (Miller, 1962; Mehler, 1963; Clifton and Odom, 1966). Certain groups of English constructions have generally been analyzed by linguists as sentence families which are assigned different surface structures but the same underlying structure. Such sentences were employed as experimental material to determine the form of the structure of sentences as stored in memory, and consequently to test the psychological correlates of underlying structures and transformational rules involved in the derivation of the surface structures. The CLEFT family, which is investigated in the present work, is one such construction. The experimental works on this problem will be referred to as <u>storage experiments</u>.

The other approach sought to determine whether or not all the members of such families and paraphrases are in fact functionally (or semantically) equivalent. In the case of the CLEFT family, for example, this question can be stated as 'Do the three types of the CLEFT construction focus a particular clefted constituent to the same extent?' The experimental research on this topic will be referred to as paraphrase experiments.

The finding that the recall of a sentence is characteristically unlike rote recall of an unorganized list of items in a serial learning task (Mandler and Mandler, 1964; Bower, 1970) and the development of formal concepts such as kernel and transformation in the transformational grammar (Chomsky, 1957) stimulated the research on the problems of how sentences are encoded and how the structure of sentences is viewed by native speakers. One of the most significant findings in the area of serial learning is the remarkable constancy of the serial position effect. The plot of the percentage of correct recall is slightly U-shaped in all cases of unorganized material. Mandler and Mandler (1964) showed that the bowed serial position curve does not appear when the stimulus lists can be interpreted as sentences. This indicates that the linguistic organization of the stimulus string has a strong influence on the subjects' performance.

A directly relevant assumption in the investigations of these problems is so-called coding hypothesis (Fodor, Bever and Garrett, 1974) that states:

(1) The base-structure tree of a sentence is stored independently of the representation of the transformations which applied to it.

(2) The representation of the transformational history of a sentence decays more rapidly than does the representation of its base structure tree.

This hypothesis was tested in various experiments (Mehler, 1963; Clifton and Odom, 1966; Blumenthal, 1967). These experiments employed as stimulus material the groups of sentences which were analyzed by linguists as a 'sentence family'. An example of the most widely used sentence families is one which consists of all the sentences which result from the application of all permissible combinations of the sets of optional singulary transformations (Chomsky, 1957) to a single terminal string. (The absence of any of these singulary transformations will be considered to be a permissible combination of transformations; thus, the kernel is a member of each sentence family.)

These experiments seemed to show that the number of transformations in a sentence was inversely related to the probability that it would be correctly recalled. However, instead of offering support for the hypothesis about the form of the stored structure in memory, the experiments invited controversies about the validity of the hypothesis

mentioned above. These studies have been criticized for a number of reasons. In the first place, such an inverse relationship between the number of transformational rules and the memorizability of a sentence does not unambiguously suggest anything about the form of the stored structure. In other words, such data provide mixed information about the stored structure and the memorial and retrieval processes (Fillenbaum, 1970; 1973).

Secondly, the linguistic theory which was the basis of the development of the hypothesis was revised within linguistics. Lees (1960) and Katz and Postal (1964) both challenged the earlier view of transformational generation of negatives, questions, and passives. Lees (1960) formulated his phrase structure rules in such a fashion that they, rather than the transformational rules, optionally introduce a negative morpheme in the generation of a phrase marker. Katz and Postal (1964) assumed that the correct form for the generative device for language is a transformational syntax and the form for the semantic component is an interpretive semantics in the sense of Katz and Fodor (1963). Katz and Postal argued that these interpretive rules for semantic interpretation should apply to the underlying phrase structure generated only by the phrase structure rules. Since the kernel and other related sentences such as questions obviously have different meaning, it was argued that these sentences must have

different underlying structures. Baker, Prideaux and Derwing (1973, p.204) also criticized the view that the kernel and the seven transformed sentences differing in voice, mood, and modality are synonymous. They argued that it cannot be said that "... subjects who recall a sentence such as 'John hit the ball,' but who fail to recall the 'negative syntactic correction' have, nevertheless, recalled the semantic content" .

Thirdly, a different interpretation was proposed for earlier experimental results. Wales and Marshall (1966) argued that the poor recall of derivationally complex sentences may be due to the complexity of their underlying structure, given the revised view of the grammar. Fodor and Garrett (1966; 1967) also proposed that the explanation in terms of surface structure parameters rather than derivational complexity could be a possible alternative for the early findings. Fodor and Garrett (1967, p.290) suggested that the complexity of a sentence is a function not (only) of the transformational distance from its base structure to its surface structure but also of the degree to which the arrangement of elements in the surface structure provides clues to the relations of elements in the deep structure. They also said that transformations generally deform the base structure trees, but this is not because of the increased transformational distance between base and surface structure per se, but because of the consequent

obliteration of the surface structure clues upon which the reconstruction of deep structure depends.

Fourthly, it has been suggested that certain sets of sentences constitute a possible contradiction to the now defunct derivational theory of complexity hypothesis. Sentences such as truncated passives or NPs with preposed adjectives seem to support a hypothesis that the processing difficulty or latency of sentences is inversely, not directly, proportional to the number of transformations stored in memory. Slobin (1963) found that truncated passives are less complicated on performance tasks than their non-truncated counterparts. Fodor, Bever and Garrett (1974) stated that sentence pairs (3) - (4) below are intuitively plausible candidates which will yield the opposite direction of complexity asymmetry predicted by the derivational theory of complexity. While the derivational theory of complexity predicts that the first sentence of each pair is simpler in processing, an intuitive judgment gives the reverse of this prediction.

(3) a. The cat which is small is on the mat which is dirty.

b. The small cat is on the dirty mat.

(4) a. That John left the party quickly amazed Bill.

b. It amazed Bill that John left the party quickly.

As sketched so far, the experimental investigation of the psychological correlates of linguistic description is still far from being complete. In the following sections, experiments dealing with the CLEFT family will be reviewed in detail and a statement will be made as to how the present experiment on naturalness judgments contributes to the study of psycholinguistics.

Hornby's Storage Experiment

Hornby (1971) supported the coding hypothesis as a tenable explication of the relationship of the formal operation of deriving sentences to a psychological process of speech production and perception. He proposed a weaker version of the coding hypothesis, namely that sentences are stored at some level more abstract than the surface structure level although not necessarily at the deep structure level. Hornby suggested that in order to test this hypothesis it is essential to develop a memory task which employs sentences having different surface structures but truly identical underlying structure. He seems to suggest that the experimental results that ran counter to the coding hypothesis are due to the fact that the

underlying structures of the sentences being compared were not really the same. Hornby predicted that if sentences are stored in some abstract form rather than as surface structures, the stored structure would be maintained whereas different surface structures would be reconstructed during recall. Consequently, there would be a considerable number of errors of recall involving the confusion of the surface structures with the same underlying structure.

Hornby adopted Akmajian's (1970) and Muraki's (1970) analyses of the CLEFT construction where cleft and pseudocleft are considered as having the same underlying structure. In his experiment, Hornby presented the subjects with a series of sixteen pictures depicting simple three-component events (actor, action, and goal) such as a boy riding a bicycle, a woman painting a fence, a girl pulling a wagon, etc. Subjects were simultaneously presented with a sentence describing the picture shown: half of the pictures were described with a cleft sentence, and the other half were described with a pseudocleft sentence. Of the eight sentences of each CLEFT type, half of the sentences had clefted subject and half of the sentences had clefted object. Thus there were four each of the cleft sentences with clefted subject, the cleft sentences with clefted object, the pseudocleft sentences with clefted subject, and the pseudocleft sentences with clefted object. Subjects were asked to watch the pictures and

listen to the sentences.

Sixty seconds after the last stimulus pair had been presented, the recall task began. In the recall task, subjects were presented with the original pictures, one at a time, and were instructed to recall the sentence that had previously been employed to describe the picture. The subjects' responses were tape-recorded. The responses were classified according to the sentence type and the correctness of preserving the operationally defined topic-comment distinction or presupposition. The terms topic and comment were used in their traditional sense of what the sentence is about and what the speaker is saying about it respectively (Halliday, 1967). For the CLEFT sentences, the sentences were scored as correct if the information contained in the clause of the original sentence was maintaind in the clause of the response sentence. For the active and passive sentences, the topic-comment distinction was considered to have been maintained if the topic preceded the comment in the surface structure. The types of sentences in subjects' responses were simple active, simple passive, cleft, pseudocleft, and reverse pseudocleft.

The results of the experiment are summarized in Table 1:

Table 1

Mean Number of Correctly and Incorrectly Recalled Topic-Comments (Hornby, 1971)

Response		Stimulus: Cleft	t	p	Stimulus: P-cleft	t	p
Cleft	Cor.	3.200	4.12	.001	2.567	2.97	.005
	Inc.	1.766			1.300		
P-Cleft	Cor.	1.100	1.72	.05	2.133	4.42	.001
	Inc.	0.533			0.567		
Active	Cor.	0.300	1.14	.20	0.433	1.98	.05
	Inc.	0.166			0.167		
Passive	Cor.	0.200	0.90	.20	0.233	1.36	.10
	Inc.	0.100			0.033		
Reverse P-Cleft	Cor.	0.367	0.83	.20	0.367	2.04	.05
	Inc.	0.267			0.133		
Total	Cor.	5.167	4.93	.001	5.733	5.11	.001
	Inc.	2.832			2.200		

As is shown in Table 1, for those responses differing from stimulus sentences the topic-comment distinction was marked correctly in the majority of the cases at the level far exceeding chance expectation. Hornby interpreted this as being an indication that sentences are stored in terms of their surface structure as well as that the topic-comment distinction may be stored and recalled independently of particular surface structure.

One other point of particular interest to the present thesis is that the reverse pseudocleft made up a proportion of the recalled responses although no reverse pseudocleft

was present in the stimuli. This is particularly interesting in the light of the well-established fact that simplifications are major errors that affect construction type in recall (Mehler, 1963). This previous finding would predict that simple actives and passives should be among the response sentences, but reverse pseudocleft should not. However, the averages of the mean number of correct actives and the mean number of correct passives for both cleft (.025) and pseudocleft (.333) stimulus sets are smaller than the mean of reverse pseudocleft for cleft stimuli (.367) and for pseudocleft (.367) stimuli respectively. In spite of the very complex nature of the reverse pseudocleft, these structures were reconstructed in an attempt to recall cleft and pseudocleft sentences. This part of Hornby's results, taken by itself, suggests that the relationship between the kind of formal analyses revieved in Chapter Two and the psychological mechanism of the memory and retrieval of sentences is very straightforward. For example, the formal description serves as a viable predictor of native speakers' intuition about formally defined sentence relatedness. But unfortunately, the next two experiments to be reviewed suggest quite the contrary.

Paraphrase Experiments

The standard theory of transformational grammar defined syntactic paraphrase as the sets of sentences which differ from one another only in the application of one or more optional transformational rules. This definition was the natural outcome of the axiom that transformations preserve meaning (Katz and Postal, 1964). However, since there has been no unique way of formulating grammatical rules nor any clear-cut criterion of semantic equvalence for a set of sentences, there has been no unanimous agreement among linguists as to what constitute paraphrase sets and what not. Fletcher (1973) attempted to classify the levels of meaning-equivalence by distinguishing different kinds of meaning. He distinguished three different levels of the term, semantics:

(a) The semantics of content (Sc), which refers to the basic information conveyed by the lexical items in the sentence, together with the structural arrangement in which they are found;

(b) The semantics of illocution (Si), which covers meaning differences which are a function of the context into which a sentence fits; Si can be subdivided into:

  (b1) The semantics of mode (Sm), which refers to the meaning of sentence types such as interrogative, negative, imperative, etc.

  (b2) The semantics of discourse (Sd), which refers to the meaning of the preceding discourse that has an effect on the meaning of the sentence.

In terms of these different semantic levels, Fletcher distinguished between weak paraphrase (P1) and strong paraphrase (P2). Two or more sentences are P1-equivalent if they are equivalent with respect to Sc and Sm; two or more sentences are P2-equivalent if they are equivalent with respect to Sc, Sm and Sd. Even the weaker requirement, namely P1-equivalence, is stronger than Sc-equivalence. Hence Fletcher excluded (4) as a member of a paraphrase set, while treating (5) - (7) as P1-equivalent, but not P2-equivalent.

(4) Joyce didn't dislike Gogarty.

(5) Was Gogarty disliked by Joyce?

(6) Did Joyce dislike Gogarty?

(7) Joyce disliked Gogarty?

Fletcher aimed at establishing a class of paraphrases among various CLEFT constructions according to the questions they co-occur with, under certain assumptions about the semantic distinctions summarized above. The experimental hypothesis was formulated as:

H1: Subjects will select, as suitable answers to a WH-question, a P2-equivalent set of clefted structures.

In other words, the prediction was that subjects would regard as equivalent answers to a question all and only

clefted sentences which have the specifying (identifying, focused, new) NP in a matrix sentence with tonic placement, but that subjects would not be affected by the voice of the embedded clause.

In the experiment, subjects were presented with 32 distinct sets of question and answers. The questions with which subjects were presented varied in voice (QV) and with respect to the NP for which specification or focusing was requested (QF) as in (8) - (11):

(8) Who did Nixon choose?

(9) Who was chosen by Nixon?

(10) Who chose Agnew?

(11) Who was Agnew chosen by?

The answer set for each question was made up of 12 CLEFT constructions which varied in type of clefting as well as in voice and focus. Subjects were asked to respond to a particular question by marking a plus sign to whichever sentences from the answer set were considered suitable. Subjects' responses were regarded as preserving or not preserving two aspects of the question, focus and voice. Each response was scored separately for focus and voice. Subjects' responses which preserved the feature of interest from the question scored +1; one which did not scored -1. Subjects' responses thus generated two distinct sets of

same/different scores, one for focus and one for voice.

The results of the experiment showed three characteristic response patterns. First, there was an obvious preference for maintaining the focus of the question in the responses. Second, there was no tendency to preserve the voice of the question in the responses. Third, there was a discrepancy between the total number of responses in the pseudocleft category and the totals in other sentence-type categories. The number of responses in the pseudocleft was significantly less than those of the other two categories. The results supported the experimental hypothesis and offered certain grounds for the definition of paraphrases in a selected area of English syntax. However, there remained a problem of dealing with three distinct subject groups which emerged from a hierarchical grouping analysis:

(a) High Focus (HF) Group, which achieved high focus preservation scores on all sentence types. This group was considered as having a developed appreciation of what the question required to be specified and what the response sentence was specifying or focusing. Thirty four among 73 subjects belong to this group.

(b) Low pseudocleft (LPC) Group, which performed the task in a similar fashion to the HF group on two of the sentence-types, Cl and Rp. This group had low and minus scores on pseudocleft responses as if it was not a focusing device at all. Nineteen subjects belong to this group.

(c) Low Focus Group (LF) Group, which showed very low focus preservation scores clustering around zero for all sentence-types. This group does not

discriminate among a set of clefted sentences according to syntactically signalled focus. Nineteen subjects belong to this group.

The HF group was considered as providing an empirical support not only for a linguistic description which accounts for P2-equivalent sentences but also for a claim that syntactic reflexes of Sd are relevant for the satisfactory description of the internal structure of sentences. The LF group did not attempt to preserve focus across question and answer. The general tendency was to look on P1-equivalent structures as suitable answers, while the total number of sentences selected by this group varied from individual to individual. The LPC group poses a problem of interpretation. Subjects in this group were generally using a focus preserving strategy. A tentative explanation in terms of structural features of pseudocleft was offered as to why this group treated pseudocleft differently from the other two sentence-types. Fletcher drew attention to the fact that in pseudocleft structures the focused item occurs at the end of the sentence following the embedded clause while the situation is reversed in cleft and reverse pseudocleft structures, with the focused item at or near the beginning of the structure. He suggested that if these differences in the linear position of the focused item are looked at as two separate focusing devices, <u>back-focus</u> and

front-focus, the difference between HF and LPC groups can be discussed in these terms: the LPC group only accepted front-focus as suitable answers while HF group regarded both front-focus and back-focus as suitable answers.

Fletcher also reported that the HF group showed two significant interactions: QV x QF at .01 level and QV x QF x ST (CLEFT type of answers) at .05 level. Since the second-order interaction is included in the third-order interaction, he examined only the latter. All other mean scores in the interaction were low on pseudocleft sentences, except for the Q/A/O (active voice with specification requested on object) stimulus-condition, where they were high. Fletcher's speculation about this was that the high scoring had something to do with a characteristic of the stimulus question as illustrated in (12):

(12) Who did Nixon choose?

This type of question has two markings for interrogation, the WH form and an auxiliary verb before the subject noun. Ascribing the reason for the interaction to the form of the question, Fletcher thought that this interaction did not have a major bearing on the interpretation of the intuition of paraphrase of the HF group.

The CLEFT constructions were experimentally

investigated by Millar (1976) to determine whether the existence of subgroups in Fletcher's experiment was a characteristic of the population at large or simply artifacts of the experimental task. Millar was interested in determining whether there were individual differences among native speakers and to what extent each CLEFT construction was a focusing device. He investigated these problems by asking subjects to compare CLEFT sentences with contrastively stressed sentences. Subjects were aurally presented with pairs of sentences: the first (target) sentence was a contrastively stressed simplex sentence whose stress was either on subject, or on object or on nothing. The second (stimulus) sentence was one of six sentence types which differed with respect to type of clefting and the constituent focused. Subjects were instructed to rate on a seven-point scale the degree to which the target sentence and the stimulus sentence emphasized the same word.

Millar formalized the effectiveness of individual CLEFT constructions as a focusing device according to focus criterion and emphasis criterion defined as follows:

> Focus Criterion. Given two similarity ratings, the similarity rating given a sentence pair which stresses and clefts the same constituent, and the similarity rating given a sentence pair which clefts and stresses different constituents, the similarity rating for the pair which stresses and clefts the same constituent should be significantly larger than the similarity rating given the pair which clefts and stresses different constituents.

Emphasis Criterion. Given two similarity ratings, the similarity rating given to a sentence pair which clefts and stresses the same constituent, and the similarity rating given a sentence pair consisting of a CLEFT sentence and an unstressed sentence; the similarity rating given the pair which clefts and stresses the same constituent should be significantly larger.

The focus criterion was said to be used to distinguish between those constructions which are viewed as focusing devices and those which are not, while the emphasis criterion is supposed to distinguish between those devices which are better focusing device than the simplex sentence and those which are not.

A hierarchical clustering analysis yielded three distinct subgroups of subjects:

(a) CLEFT-Focus Group, which considered all members of the CLEFT family to be focusing devices. However, the cleft and reverse pseudocleft sentences were considered to be both focus and emphasis devices, the pseudocleft sentences were only considered to be a focus device. Therefore, by definition, pseudocleft sentences were not as effective focusing device as the cleft or reverse pseudocleft sentences. This group consisted of 53.5% of the sample.

(b) Linear Order Group, which viewed the cleft and the reverse pseudocleft sentences as focusing devices according to the focus criterion. But pseudocleft sentences were not focusing devices. Only front clefting devices were considered to be a focusing device. This group consisted of 22.6% of the sample.

(c) Contrastive Stress Group, which viewed all the members of the CLEFT sentence family as effective focusing device according to the focus criterion.

This may have arisen out of subjects' high sensitivity to stress and intonation. This group consisted of 23.9% of the sample.

In evaluating his own experiment, Millar expressed a worry that experiments may reflect more of the inventive aspects of the way people can play with language rather than reflect something which is of pertinence in the ordinary interpretation of everyday speech. He speculated that the members of the linear order group might have merely concentrated on the linear-order of the words in the sentence rather than respond to the syntactic characteristics of the CLEFT sentences and that the Stress Group might have been matching the words in the various sentences according to loudness. Millar thought that there could be some low level phenomena which subjects could have used without even having to interpret the sentences. He noted the similarity of the first two subgroups of Fletcher's experiment and his own experiment. The first group of both experiments treated all the members of the CLEFT family as focusing devices, while the second groups treated the cleft and reverse pseudocleft but not pseudocleft, as focusing devices. Millar also argued that the apparent difference between Fletcher's LF group and his own Stress Group could disappear upon closer examination, suggesting that the difference might have been caused by modes of presentation of experimental material. He speculated that the lack of systematicity of the responses

in Fletcher's LF Group might have been due to variation in the way the subjects in this group read the sentences to themselves in conjunction with their high reliance upon intonation in determining the focus of the sentence. This group could have been a high stress (or intonation) group, if it had been presented the material aurally. The existence of the parallel groups in the two experiments was taken to support the notion that both experiments were measuring the same phenomenon and this in turn was said to eliminate the question as to the ad hoc nature of the results of the experiments.

The Present Experiment and Psycholinguistics

Hornby's (1971) experiment showed that the three types of CLEFT construction are indistinguishable at a certain psychological level. As Fillenbaum (1970; 1973) pointed out, there is no way of knowing whether such members of a sentence family are equivalent as outputs of storage or as outputs of storage plus retrieval processes. Granting this shortcoming of experimental technique, it is still possible unambiguously but rather loosely to assign psychological status to a sentence family. If it is assumed that a sentence family is a group of sentences which are interchangeable at a level of output of storage plus

retrieval processes, then Hornby's results provide support for the formal argument that cleft, pseudocleft and reverse pseudocleft constitute a family, regardless of the differences found in the treatment of the three CLEFT types in other experiments. Now, the problem is how to make sense out of the seemingly contradictory empirical findings from the storage experiment and paraphrase experiments so far reviewed.

If we look at the experimental procedures of these experiments, we can find one significant difference. In the recall experiment, the recall task was given 60 seconds after the presentation of the stimulus sentences. According to Sachs (1974), syntactic properties of sentences tend to be forgotten when the delay is 20 syllables or greater. In the light of this finding, a 60 second delay in Hornby's experiment is long enough for syntactic characteristics of the sentences to be forgotten. In Fletcher's experiment, all the sentences were presented in a written form, while in Millar's experiment, the material was presented aurally but the responses were required to be given immediately after the presentation without a forced delay. In both of these paraphrase experiments, subjects had access to syntactic characteristics at the time of response. It is reasonable to suppose that the homogeneity of the three CLEFT types in Hornby's results is based on the

functional or semantic properties of the three construction types while the heterogeneity shown by subgroups from the paraphrase experiments is due to syntactic characteristics in addition to functional properties of the sentences. Consequently, the difference between the recall experiment and paraphrase experiments could be due to the difference in strategies and heuristics adopted by subjects depending on the mode of presentation of the experimental material.

Careful examination should be directed to the characterization of subgroups of native speakers of a language. The presence of subgroups in the paraphrase experiments does not suggest at all that each subgroup has internalized different rules of English but simply suggest that each subgroup has adopted a unique strategy and that their mental set was tuned to some specific aspects of sentences. As Fromkin (1975) pointed out in reaction to Ohala's (1973) experiment testing the validity of certain phonological rules, the kind of discussion about subgroups appearing in Fletcher (1973) and Millar (1976) is speculation concerning strategies used by the subjects but not speculation about the kinds of rules which could account for linguistically relevant formal or perceptual phenomena. It is not difficult to infer that any speaker of English, given the proper direction, can actually become sensitive to the syntactic properties which only the LPC

Group in Fletcher's experiment and the Linear Order Group in Millar's experiment happened to be sensitive to. Therefore, the problem of determining the properties of such syntactic characteristics is within the realm of the study of grammar and sentence perception which can be attributed to the whole population of the native speakers. Leaving the question of what makes such individual difference in strategies or in attitude toward a certain set of experimental material to the psychologists engaging in the theory of personality or individual differences, linguists or psycholinguists should direct their attention to the problem of perceptual relevance of a certain set of syntactic properties.

It is important to note that there appear to be syntactic characteristics which may only influence an initial parsing of the sentence and which serve no functional role at a deeper level of processing. In other words, there are functionally redundant syntactic features at that level. For example, the fact that English sentences normally do not permit sequences of four (non-conjoined) NP's seems to facilitate parsing but serves no semantic function at that level. The present experimenter assumes that these syntactic features <u>do</u> influence the initial stage of the comprehension of sentences even though they no longer operate at a subsequent level at which the

intuition about sentence families operates. That is, such syntactic properties may contribute to the parsing of the sentence but once that parsing is completed, the properties are no longer needed for processing. The following empirical results therefore emerge from the studies reviewed above:

(i) there are common functional properties of the CLEFT constructions which operate at one level of processing,

(ii) there are certain syntactic properties which are functionally empty at that level but operate at another level.

With these findings, the psycholinguist must ask two questions: how those properties influence native speakers' perception and what those properties are. It is assumed that the semantically empty syntactic properties constitute a quantifiable dimension of naturalness defined as the property of a sentence which determines the subjects' readiness to produce the sentence and the ease or difficulty involved in its comprehension given an appropriate situation. A null hypothesis is formulated under this assumption and the empirical findings (i) and (ii):

Null Hypothesis: There is no difference in naturalness judgments associated with each of the three CLEFT types.

The present experiments are designed to investigate whether the former question is a matter of the degree of naturalness associated with each construction type by testing the null hypothesis and to answer the latter question by surface syntactic analysis (Prideaux, 1975) in conjunction with the regression analysis based on the experimental data and the outcome of the syntactic analysis. Consequently, the three experiments reported in the following chapter address the issue of naturalness directly and provide the data for establishing a set of syntactic determinants of the naturalness of sentential structures of English.

CHAPTER FOUR

THE EXPERIMENTS

This chapter is devoted to the description of the three experiments and to a preliminary discussion of their results. Experiment I, the main experiment of the present study, was designed to investigate the nature of the perceptual relevance of wholistic characteristics of the CLEFT constructions and to provide data for the analysis of such characteristics into distinct syntactic properties. The question of perceptual relevance was posed from the viewpoint of naturalness: Is the non-funtional (or non-semantic) difference a function of the naturalness of the CLEFT types?

Three independent variables were tested; voice of the embedded clause (V, two levels), focused constituent (F, two levels), and CLEFT type (T, three levels). Naturalness rating was the dependent variable. The names and abbreviations for the levels of each of the independent variables are shown below:

factor	level	name and abbreviation
V	1	active (Ac)
	2	passive (Pa)
F	1	focus on agent (Ag)
	2	focus on patient (Pt)
T	1	cleft (Cl)
	2	reverse pseudocleft (Rp)
	3	pseudocleft (Pc)

The interpretation of the results was ultimately formulated as a set of syntactic determinants of naturalness, each assigned a specific weight. This formulation was obtained through three steps. First, the surface syntactic analysis of the 12 different sentence types (described below) of the CLEFT construction was carried out and a set of five naturalness predictors (or determinants) was obtained. Next, the validity of the predictors was tested against a broad range of English sentences in two independent experiments to assure that the predictors were not merely ad hoc statements relevant only to the CLEFT family. They were found to generalize across wide range of sentences. The final step was to conduct a multiple regression analysis with the five predictors in order to obtain the best fitting prediction equation of the naturalness with a differential weight assigned to each predictor.

Experiment I

Experiment I was designed to collect empirical data for the naturalness ratings associated with various CLEFT constructions. The null hypothesis to be tested was:

H: There is no difference in naturalness judgments associated with Cl, Rp, and Pc.

On the basis of the results of this experiment, a syntactic analysis of the various CLEFT constructions yielded a set of syntactic determinants of the naturalness of such constructions. Ultimately, these syntactic determinants together with observed means associated with various sentence types were submitted to a multiple regression analysis which produced a prediction equation of naturalness.

Method

Subjects. Thirty-six subjects participated in the experiment. Twenty of the subjects were students in an elementary mathematics course at the University of Alberta during the summer session of 1977. The remainder were drawn randomly from University Married Students' Residence. The former group was asked to do the test at

the end of a classroom session on a voluntary basis. Subjects in the other group also volunteered and did the test individually. Subjects were not paid nor materially rewarded. Subjects were all native speakers of English. None of them had received formal training in linguistics.

The Materials. Combination of the three main factors yielded twelve sentence-types (ST). Three sentences in each of the 12 types were constructed, giving three tokens for each type and yielding a total of 36 test sentences. The following are the sentence-types and examples:

ST1: active cleft with focus on agent (Ac-Ag-Cl)
It was John that kicked Mary.

ST2: active reverse pseudocleft with focus on agent (Ac-Ag-Rp)
John was the one who kicked Mary.

ST3: active pseudocleft with focus on agent (Ac-Ag-Pc)
The one who kicked Mary was John.

ST4: active cleft with focus on patient (Ac-Pt-Cl)
It was Mary that John kicked.

ST5: active reverse pseudocleft with focus on patient (Ac-Pt-Rp)
Mary was the one who John kicked.

ST6: active pseudocleft with focus on patient (Ac-Pt-Pc)
The one who John kicked was Mary.

ST7: passive cleft with focus on agent (Pa-Ag-Cl)
It was by John that Mary was kicked.

ST8: passive reverse pseudocleft with focus on agent (Pa-Ag-Rp)
John was the one by whom Mary was kicked.

ST9: passive pseudocleft with focus on agent (Pa-Ag-Pc)
The one by whom Mary was kicked was John.

ST10: passive cleft with focus on patient (Pa-Pt-Cl)
It was Mary that was kicked by John.

ST11: passive reverse pseudocleft with focus on patient (Pa-Pt-Rp)
Mary was the one who was kicked by John.

ST12: passive pseudocleft with focus on patient (Pa-Pt-Pc)
The one who was kicked by John was Mary.

In constructing the stimulus sentences, one could have derived the 12 different ST's from one basic sentence, as in the above example, in order to to control the possible source of experimental error. However, this would likely lead subjects to notice that the sentences are related and tempt them to deliberately compare the sentences with each other. This might elicit some sort of conscious strategy rather than a spontaneous judgment. Therefore, the selection of lexical items was intended to be random as long as the use of the items in a sentence did not conflict with native speakers' intuition.

Two other considerations were important in preparing the stimuli. First, 12 sentences which were not CLEFT constructions were included in the stimulus set as distractors. Among them were a sentence with many central embeddings such as (1) and a sentence with a disjunctive verb-particle construction with a long intervening noun phrase such as (2):

(1) The soldiers the president the student visited honored shot 73 birds.

(2) I called the man who wrote the book that you told me about up.

Also there were sentences which were very simple, straightforward, and frequently used such as (3) and (4):

(3) She feels fine today.

(4) Mary played tennis.

These distractors were included so that they could provide subjects with an anchor for what kinds of sentences may be very natural and what kinds may be quite unnatural. In order to avoid confusion between two groups of stimulus sentences, the sentences other than the distractors will be referred to as the "test sentences". The set of 48 sentences, including distractors, was randomized in order to eliminate any possible ordering effect. Every subject was given a different order of sentences.

Procedure. Subjects were presented with a booklet which contained the instructions and stimulus sentences. They were instructed to rate sentences according to their degree of naturalness on a seven point scale where '1' was the least natural end and '7' was the most natural end. They were asked to put a circle around a number on the scale

that best indicated their judgment of the degree of naturalness of the sentence. The scale was printed directly below each sentence.

It was suggested to subjects that they were expected to be consistent as to the criteria for their judgment. The recommended criteria were how much subjects would be inclined to use and how easy it would be to understand the sentence in question. For example, the rating '7' was to be given to the sentences which they would readily use and easily understand, given an appropriate situation; the rating '1' was said to be reserved for the sentences which are hard to understand and which would never be used in any context; the rating '4' was described as appropriate for those sentences which the subject can understand but would not use. Subjects were also told that the intervening ratings should be determined relatively with respect to these anchor points.

Subjects were encouraged to say each sentences to themselves so that they could base their rating on the spontaneous impression of what was spoken instead of what was written. They had five practice sentences before the experimental task. Complete instructions and stimulus sentences are found in Appendix A and C respectively.

Results and Discussion.

The obtained naturalness ratings for the randomized stimulus sentences were derandomized and the ratings for the distractors were eliminated from the input data to the statistical analysis. The data were analyzed by analysis of variance. The design was a four-way factorial with each combination of V, F, T, and S (subjects), with three replications (R). V, F, and T were fixed, while S and R were treated as random. Table 2 presents the results of the analysis of variance.

Table 2

Analysis of Variance

SOURCE	ERROR TERM	F	SUM OF SQUARES	DEG. OF FREEDOM	MEAN SQUARES
MEAN	S	870.52***	25422.5	1	25422.5
V	VS	107.75***	264.966	1	264.966
F	FS	3.06	4.69444	1	4.69444
T	TS	32.90***	131.228	2	65.6142
S	R(VFTS)	19.00***	1022.13	35	29.2038
VF	VFS	106.91***	308.198	1	308.198
VT	VTS	0.11	0.302399	2	0.151199
FT	FTS	1.61	5.16661	2	2.58331
VS	R(VFTS)	1.63*	87.6968	35	2.50562
FS	R(VFTS)	1.00	53.7454	35	1.53558
TS	R(VFTS)	1.30	139.592	70	1.99417
VFT	VFTS	13.52***	39.4861	2	19.7430
VFS	R(VFTS)	1.88**	100.900	35	2.88285
VTS	R(VFTS)	0.86	92.8396	70	1.32628
FTS	R(VFTS)	1.04	112.208	70	1.60297
VFTS	R(VFTS)	0.95	102.205	70	1.46007
R(VFTS)			1327.81	864	1.53682

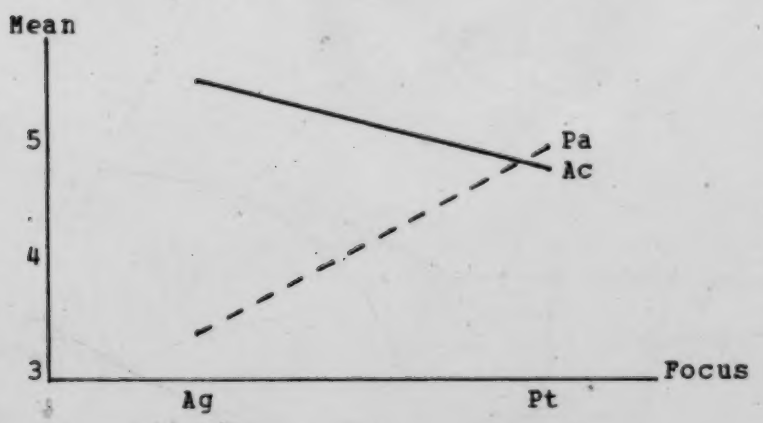
Although the effects of S, VS, and VFS were significant, no interpretation will be given to the significance of these effects in the present thesis, since it is most likely that these effects were due to the individual difference in perceptual ability and cognitive style (Hettema, 1968) and no profile of subjects are available.

The main effect of V was significant. The CLEFT constructions with an active embedded clause was perceived to be more natural than those with a passive clause. The effect of T was significant. Pc turned out to be significantly less natural than Cl and Rp. This leads to the rejection of the null hypothesis that there is no difference in naturalness judgments associated with Cl, Rp, and Pc.

The VF interaction was also found to be a significant source of variation. As is shown in Figure 1, the sentences with a focus on Ag and a passive clause were the least natural among the four combinations of V and F. This seems to reflect the intuitive feeling about the semantic nuance of passive voice, namely that passive voice is appropriate when the sentence is about the patient of an action, with no particular attention given to the agent of the action. Considering this intuition and a common observation that passive sentences are often "agentless", it can be argued that the significance of VF interaction is an

indication that passive voice is primarily a device for highlighting the patient. Consequently, the low naturalness associated with sentences with a passive clause and a focus on the agent can be interpreted as being due to the conflict between the inherent function of the passive and the function of the cooccurring focus on the agent.

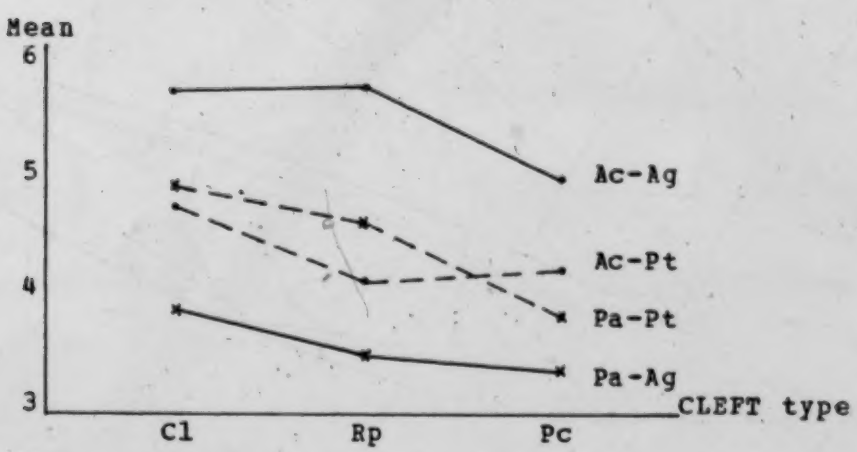
Figure 1. VF Interaction



As can be seen in Figure 1, it is obvious that the more natural combinations of V and F are Ac with a focus on Ag and Pa with a focus on Pt.

The VFT interaction was significant. Since this is the highest order interaction of interest, careful consideration is in order.

Figure 2. VFT Interaction



As can be seen in Figure 2, the difference in naturalness between Pc and the other CLEFT types is larger for the more natural combinations of V and F (Ac x Ag and Pa x Pt) while it is smaller for the less natural combinations (Ac x Pt and Pa x Ag). From Figure 2, it can be seen that the profiles for the two more natural combinations are roughly parallel and those for the two less natural combinations are parallel as well. The VFT interaction must therefore be due to the interaction of T and the degree of naturalness in the combination of V and F. In case of more natural combinations, Pc is far less natural than Cl and Rp. On the other hand, in case of less natural combinations, Pc and Rp together are less natural than Cl.

It is difficult to offer an immediate interpretation of this complicated interaction. Syntactic analyses of the 12

ST's were performed to establish a set of predictors of naturalness of the different ST's. This predictor set will serve as an interpretation of VFT interaction.

Naturalness judgments associated with sentences must be a function of the perceived syntactic characteristics of sentences, of course at a surface level. The syntactic analysis to be presented shortly was conducted under the constraint that the analysis must state generalizations which are true at the surface, the constraint which is the most important principle of the syntactic analysis in the Information Structure Theory of language (Prideaux, 1975). From the functional point of view, syntactic devices should be catalogued (taxonomized or related) as a function of the kinds of information they convey (Baker, 1977). From the perceptual point of view, on the other hand, syntactic properties can be regarded as inherently carrying a specific perceptual weight (for example, a naturalness weight) depending on their perceptual salience. The following syntactic analysis and the regression analysis were predicated upon this view and were intended to determine such syntactic properties and the associated naturalness weights.

Table 3 presents the results of the syntactic

analysis. There are five syntactic properties which were established as predictors of naturalness or simply "predictors". These predictors are manifested as either of the two realizations: one which intuitively operates toward the increase of naturalness and one which seems to operate toward the decrease of naturalness. These predictors were considered as counter variables which take the value '1' when some effect was present and '0' when that effect is not present (Winer, 1972). The values assigned to the realizations of each predictor were based on the binary intuition of the present writer. The numbers in the parentheses in Table 3 represent the STs which contain the realization on the same row of the table.

Table 3

Predictors of Naturalness

Predictor	Realization	Value
A. Position of the embedded clause	central embedding (3,6,9,12)	0
	extraposition (1,2,4,5,7,8,10,11)	1
B. Ordering of clefted NP & be	clefted NP-be (2,5,8,11)	0
	be-clefted NP (1,3,4,6,7,9,10,12)	1
C. No. of consecutive NP's	more (4,5,6,7,8,9)	0
	less (1,2,3,10,11,12)	1
D. No. of instances of the same lexical item	more (7,8,9,10,11,12)	0
	less (1,2,3,4,5,6)	1
E. Relative order of NPs and NPx	NPx NPs (3,4,5,7,8,12)	0
	NPs NPx (1,2,6,9,10,11)	1

Predictor A, position of the embedded clause, pertains to the distinction between the ST's 3, 6, 9, 12 and the ST's 1, 2, 4, 5, 7, 8, 10, 11, namely the distinction between the Pc and the other two CLEFT types (Cl and Rp). The former group of the sentences have a center-embedded clause while the latter have an embedded clause at the end of the sentence. Predictor B, relative ordering of the clefted NP and the copula, distinguishes the Rp from the Cl and the Pc. Predictor C, number of consecutive NP's, makes distinction between ST's 4, 5, 6, 7, 8, 9 and ST's 1, 2, 3, 10, 11, 12, i.e., the distinction between the ST's with the more natural combination of V and P and the ST's with less natural combination as mentioned earlier in this chapter. The number of consecutive NP's refers to the number of NP's between the two occurrences of verbs or between a sentence (not clause) boundary and a verb. The relative pronoun preceded by the preposition 'by' as in ST's 8 and 9 was counted as one NP regardless of the preceding preposition. In the sample sentence of ST 8, for instance, the underlined part the one by whom Mary, preceded and followed by verbs was analyzed as having three consecutive NP's. In the examplar sentence of ST 1, on the other hand, John that was counted as containing two NP's. Predictor D, number of instances of the same lexical item, refers to the number of occurrences of the same lexical item in a sentence. In the case of CLEFT constructions, this lexical item happens to be the copula. This predictor pertains to the distinction

between the first six ST's and the last six ST's. Predictor E, relative ordering of NP's, concerns the relative ordering of the grammatical subject and another NP of a simple sentence when realized in the corresponding CLEFT constructions. Simple basic sentences are assumed to be sentences which contain no embeddings (Keenan, 1976) and express just those propositions in which none of the arguments are themselves propositions (Prideaux, 1978). Under this definition, the basic structure associated with ST 3 is the structure such as "John kicked Mary.", and the basic structure associated with ST 10 is the one like "Mary was kicked by John.". The basic structure of ST 10 is not an active sentence or a kernel as advocated in Syntactic Structures (Chomsky, 1957), but a simple passive sentence. In ST 3 (e.g., "The one who kicked Mary was John."), for example, the grammatical object of its corresponding simple sentence (e.g., "John kicked Mary.") is preceded by its grammatical subject. On the other hand, in ST 10 (e.g., "It was Mary that was kicked by John.") the grammatical subject precedes another NP.

By using the five predictors, the 12 ST's are differentiated from each other by the combinations of 1's and 0's as shown in Table 4:

Table 4

Combinations of Naturalness Values

ST	A	B	C	D	E
Ac-Ag-Cl	1	1	1	1	1
Ac-Ag-Rp	1	0	1	1	1
Ac-Ag-Pc	0	1	1	1	0
Ac-Pt-Cl	1	1	0	1	0
Ac-Pt-Rp	1	0	0	1	0
Pa-Ag-Cl	0	1	0	1	1
Pa-Ag-Cl	1	1	0	0	0
Pa-Ag-Rp	1	0	0	0	0
Pa-Ag-Pc	0	1	0	0	1
Pa-Pt-Cl	1	1	1	0	1
Pa-Pt-Rp	1	0	1	0	1
Pa-Pt-Pc	0	1	1	0	0

Before conducting a multiple regression analysis which will yield the best fitting weights for each predictor to formulate the prediction equation for naturalness, it is necessary to test the generality of each predictor in order to assure that the established predictor set is not an ad hoc feature peculiar to CLEFT constructions and inapplicable to other English sentential structures. Two more experiments were designed to test whether these predictors, when taken individually, are valid for a broader range of English sentences. Experiment II was designed to be a liberal test and Experiment III, a more conservative test of the generality of the predictors. The verification of the generality by Experiment III will be considered to be more conclusive, while the verification by Experiment II will be regarded only as giving some justification for conducting

further analyses on the predictor set.

Experiment II

Experiment II was designed to investigate the generality of the predictors against a broader range of English sentences. In this experiment, pairs of sentences were constructed in such a way that the two sentences of each pair differ as to the realization of the same predictor: one of them has the realization with the value of '1'; the other, the value of '0'. Since this experiment was intended to be a liberal test compared with Experiment III, only binary judgments were asked to be made as to the naturalness of the sentences. Consequently, one of the sentences in each pair was necessarily reported as more natural than the other without a specification of how much more natural it was. If the results of this experiment show that the predictors are good measures of the naturalness of English sentences other than the CLEFT constructions, this suggests that the predictors are general enough to conduct a regression analysis based on them. In this experiment, as well as in Experiment III, all the predictors were tested at the same time. Eventually, however, five independent groups of ratings associated with

each predictor were established and each group of data was analyzed separately.

Method

Subjects. Thirty-three subjects participated in the experiment. The subjects were students taking an introductory linguistics course at the University of Alberta during the winter session of 1977. They had studied phonetics, phonology, and morphology but had no syntactic training at the time of this experiment. They were all native speakers of English. Subjects were asked to do the task on a voluntary basis in the class. There was no reward.

The Materials. Four sentences were constructed for each of the predictors. Each was transformed into a sentence which had the realization of the predictor which was not present in the original sentence. For instance, (5) was chosen and transformed into (6) and these two sentences constituted a pair.

(5) That she is in Montreal with him surprises me.

(6) It surprises me that she is in Montreal with him.

In this way, four pairs of sentences for each of the five predictors were obtained, yielding a total of 40

sentences. Examples of the sentences for each realization of the predictors are shown in (7) - (11). The underlined Roman letter and the numeral preceding each sentence signify the relevant predictor and its naturalness value respectively.

(7) A0: That he refused tc come was impolite.
A1: It was impolite that he refused to come.

(8) B0: In the garden was where I found John.
B1: It was in the garden that I found John.

(9) C0: I know the boy whose parents the principal summoned.
C1: I know the boy whose parents were summoned by the principal.

(10) D0: This is the book that is very interesting to me.
D1: This is the book that interests me very much.

(11) E0: At the report the premier was surprised.
E1: The premier was surprised at the report.

Distractors were not needed in this paired-comparison experiment. The pairs of sentences were randomized with one restriction that no two pairs sharing the same predictor followed each other.

Procedure. Subjects were presented with a printed booklet which contained instructions and stimulus sentences. They were asked to rank the naturalness of the sentences in each pair by comparing them with each other. They were instructed to use the rankings '2' and '1' for the more natural member and for the less natural member of the

pair respectively. The ratings were to be written in the parentheses following each sentence. Subjects were told not to refer back to any pairs which they had already finished ranking lest they should be tempted to copy the rankings of the previously finished pairs. They were given three practice sets before the experimental test. Complete instructions and stimulus sentences are presented in Appendix B and D respectively.

Results and Discussion

Ratings were divided into five separate groups, each of which consisted of judgments assigned to sentences with one or the other realization of each of the five predictors. Each group of data was analyzed by analysis of variance.

The design was a two-way factorial with each combination of P (realization of the predictor; two levels) and S with four replications. As shown in Table 5, all the F-ratios were highly significant. This suggests that the predictors are general enough to be applicable to a broad range of English constructions by a liberal standard. The result is considered to be an indication that conducting the regression analysis with these predictors is justified.

Table 5

Summary of the Analyses of Variance

Predictor	Realization	Mean	F-ratio
A. Position of the embedded clause	central embedding	1.0985	
	extraposition	1.9015	148.21***
B. Ordering of clefted NP & be	clefted NP - be	1.3939	
	be - clefted NP	1.6061	10.52**
C. No. of consecutive NP's	more	1.1970	
	less	1.8106	36.53***
D. No. of instances of the same lexical item	more	1.2667	
	less	1.7212	39.95***
E. Relative order of NPs and NPx	NPx - NPs	1.0227	
	NPs - NPx	2.3561	585.31***

Experiment III

Experiment III was also designed to investigate whether the individual predictors validly assess the naturalness of English sentences other than the CLEFT constructions. In this experiment, which was intended to be a more sensitive test than Experiment II, the judgments were made on a seven-point scale instead of as a forced choice decision. Naturalness ratings were collected for pairs of sentences each member of which had a different realizatiion of one of the predictors. All the predictors were tested but each predictor was analyzed separately.

Method

Subjects. Forty-two subjects participated in the experiment. All were students registered in a phonetics course at the University of Alberta during the winter session of 1977. They were all native speakers of English, and had received no training in syntax. The test was given at the beginning of a regular classroom session. There was no reward.

The Materials. The test sentences for this experiment were identical with those of Experiment II. The 12 distractor sentences used in Experiment I were included in the stimulus set. The inclusion of the distractors had a dual purpose. First, it was expected that the distractors could provide subjects with an anchor for judgments. Second, it was intended that the distractors would make it less easy for subjects to detect the contrastive realizations from the four repetitions of the same contrast. The stimulus sentences were randomized, without pairing the members of each pair, to eliminate any possible ordering effect.

Procedure. The procedure of this experiment was exactly the same as that of Experiment I. Subjects were presented with a booklet which contained intructions and 52 stimulus sentences. Subjects were instructed to rate sentences according to their degree of naturalness on a

seven-point scale. Subjects had five practice sentences before the experimental task began. Complete instructions and stimulus materials are found in Appendix A and D respectively.

Results and Discussion

Ratings for the distractors were eliminated from the data, which were then divided into five separate groups depending on the predictor being tested. These five separate groups of data were analyzed by analysis of variance. The design was a two-way factorial with each combination of P and S with four replications. The results are summarized in Table 6.

Table 6

Summary of the Analyses of Variance

Predictor	Realization	Mean	F-ratio
A. Position of the embedded clause	central embedding	3.7381	
	extraposition	5.4048	114.35***
B. Ordering of clefted NP & be	clefted NP - be	3.9821	
	be - clefted NP	4.3274	5.33*
C. No. of consecutive NP's	more	4.4940	
	less	5.3571	18.93***
D. No. of instances of the same lexical item	more	5.7321	
	less	6.4405	52.00***
E. Relative order of NPs and NPx	NPx - NPs	3.7262	
	NPs - NPx	6.7976	410.89***

All the F-ratios were significant. The results indicate that the predictors are valid measures of naturalness of broad range of English sentences. Since this experiment was designed to be a more sensitive and severe test than Experiment II, it is concluded that the generality of the predictors was conclusively verified and that proceeding to the multiple regression analysis with the predictor set is fully justified.

Multiple Regression Analysis

On the basis of the set of predictors, a multiple regression analysis was used to obtain the best fitting weight for each predictor and thereby to establish the best linear prediction equation for the observed mean naturalness values associated with ST's. The results of the regression analysis are summarized in Table 7.

Table 7

Summary of Multiple Regression Analysis

VARIABLR	MULTIPLE REGRESSION(R)	R SQUARE (RSQ)	RSQ CHANGE	REGRESSION COEFFICIENT
E	0.40868	0.16702	0.16702	0.3356487
A	0.56135	0.31511	0.14809	0.7731500
B	0.58400	0.34105	0.02594	0.3009274
C	0.79107	0.62579	0.28474	0.8634239
D	0.98853	0.97718	0.35139	0.9043201
(CONSTANT)				2.661263

The resulting regression equation of the predicted mean (PM) is the following, where the numerical values preceding an alphabetic predictor code are the weights assigned to the predictor and the last numerical value is a constant:

$$PM = 0.7731500A + 0.3009274B + 0.8634239C + 0.9043201D + 0.3356487E + 2.661263$$

The multiple correlation coefficient was 0.98853, which means that 97.7% of the total variation in the naturalness values obtained from Experiment I is explained by the five predictors. The comparison of the obtained means and predicted means, and residual are found in Appendix E. The experiments provided empirical justification for the five predictors of naturalness. The implications for perceptual strategies associated with each of the predictors will be discussed in Chapter Five.

CHAPTER FIVE

GENERAL DISCUSSION

Perceptual Mechanisms and Naturalness Judgments

In their discussion of the psychological processing involved in relating the form of a sentence to its meaning, Bever and Langendoen (1971) pointed out in vague terms that "the mapping operation is at least partially independent of the grammatical rules that relate internal and external structure". Given an internal (semantic or functional) structure M and its external (surface) structures X, Y and Z, then the operations mapping M and X, M and Y, and M and Z must be different. Consequently, the perceptual mechanism which carries out the mapping operation differs from operation to operation. It is reasonable to suppose that the perceptual mechanism is associated with a differential degree of processing difficulty depending on the kind of mapping operations it carries out. Since the internal structure M is presumably constant, the differential processing difficulty is necessarily a function of the differences among the external structures

X, Y and Z. The difference is semantically or functionally irrelevant and resides in surface structure.

Insofar as there is a phenomenon P which is a function of syntactic variables as well as semantic and/or phonetic variables, the portion of P due to syntactic variables can be investigated by keeping other variables constant. In Experiment I, naturalness judgments of the CLEFT construction, a portion of the perceptual phenomenon, were measured by keeping the semantic aspects of sentences constant. The grounds for arguing that semantic variables were kept constant was provided by various formal and experimental studies: formal studies showed that there are certain formal characteristics that can only be explained by postulating the same deep structure; and an experimental study by Hornby (1971) showed that the three types of CLEFT constructions were confused after surface syntactic features were forgotten. As mentioned in Chapter Four, Experiment I was designed to tap directly the intuition about the naturalness of sentences by analyzing subjects' response to the surface features of the given sentences.

The evolution and the acquisition of language, which are products of a dynamic interaction between the rules for mapping sound and meaning and the behavioral mechanisms used to process such mapping operations (Bever & Langendoen, 1971) occurs in such a way that sentences

requiring a heavy perceptual load in processing tend to become less favored in the language. At an extreme end of this tendency is a case where certain linguistic stuructures are not found in human language because they are too complex to be processed perceptually (Bever, 1970). For example, in the historical development of English relative clause formation, a relative pronoun preceding the main verb of the relative clause has never been omissible when the clause modifies a noun that is initial within its own clause (Bever & Langendoen, 1971). Therefore, the relative pronoun in (1) has never been allowed to be omitted and the structure such as (2) has never existed in "standard" English.

(1) The girl who ate the baklava was fat.

(2) The girl ate the baklava was fat.

This might be due to a perceptual strategy that a string consisting of a nominal phrase is the beginning of a sentoid and the verb phrase is the end of such a sequence. The presence of this strategy produces a temporarily misleading analysis of (2) such as (3) instead of the correct one such as (4) and thus makes (2) less favored.

(3) [[the girl ate the baklava] was fat]

(4) [the girl [ate the baklava] was fat]

Since naturalness was defined as the property of a sentence which determines the subjects' readiness to produce the sentence and the ease or difficulty involved in its comprehension, it is assumed that naturalness ratings are quantified perceptual complexity. Under this assumption, the interpretation of the experimental results should ultimately be extended to the discussion of perceptual strategies involved in naturalness judgments.

Perceptual Explanation of the Syntactic Determinants of Naturalness

In this section, an attempt is made to provide a perceptual explanation for each of the predictors proposed in the previous Chapter. Predictor A, the position of the embedded clause, is closely tied to the fact that speech is produced and processed sequentially in a rapidly fading auditory modality (Slobin, 1973). The perceptual studies of embedding (Chomsky and Miller, 1963; Fodor and Garrett, 1967; Blumental, 1967), especially double-embedding which is incomprehensible to the native speakers but alleged to be grammatical by some linguists, have become classic examples within psycholinguistic research. Fodor and Garrett (1967) proposed that the difficulty of such

sentences is due to their density, i.e., to the number of deep structure nodes per word in the surface structure, which exceeds some critical threshold. This proposal was shown to be potentially incorrect by some intuitive counter-examples (Bever, 1970). For example, (5) with a higher density is absolutely comprehensible and acceptable while (6) with a lower density is not, contrary to Fodor and Garrett's prediction.

(5) The man watched the girl leaving the sleeping boy.

(6) The boy the girl the man left watched left.

Chomsky and Miller (1963) attempted to formulate a perceptual principle that could explain the difficulty of doubly center-embedded sentences. They argued that any perceptual rule may not interrupt its own operation more than once. Bever (1970) criticized this principle saying that there is no theoretical motivation or explanation for one interruption being acceptable and two interruptions being entirely unacceptable. However, Chomsky and Miller's principle seems to be empirically motivated. Slobin (1973) proposed perceptual strategies or oprating principles associated with several potential universals of language acquisition. One of the universal tendencies he described was that "the greater the separation between related parts of a sentence, the greater the tendency that

the sentence will not be adequately processed". He explained that this universal phenomenon is due to what can be called Strategy 1:

Strategy 1: Avoid interruption or rearrangement of linguistic units.

Unfortuately it was not made clear what linguistic units Slobin was talking about. To make sense out of the strategy it is necessary to refer to the units of the simple basic structures of the language in question as defined in the previous chapter.

Returning to Predictor A, it was found that central embedding is significantly less natural than extraposition. In case of central embedding, the subject NP and the verb of the matrix sentence are separated by the embedded clause. This indicates that the naturalness judgment about the position of the embedded clause must be based on Strategy 1 which rejects interruption of the integrity of the related linguistic units.

Predictor B, relative ordering of the clefted NP and the copula, has to do with the so-called GIVEN-NEW strategy (Clark & Haviland, 1974; Clark & Clark, 1977). The ordering of the clefted NP - copula amounts to the ordering of NEW information and GIVEN information from an

informational point of view. The clefted NP - copula ordering amounts to the ordering of NEW-GIVEN, because the clefted NP in CLEFT constructions carries NEW information. Since only one NP can precede the copula, the GIVEN information necessarily follows the copula and consequently comes after NEW information. By the same logic, the copula - clefted NP ordering is identical to the GIVEN-NEW ordering. Halliday (1967), Hornby (1971; 1972; 1974), and Sgall, Hajicova and Benesova (1973) among others have observed that GIVEN information tends to precede NEW information. It is quite natural to expect that natural languages are designed in such a way that the human processing mechanism can easily accomodate this distinction.

At this point, two cases of processing GIVEN and NEW information can be sketched, at least schematically. If NEW precedes GIVEN, the hearer does not know what to associate NEW with in his memory. He (a) temporarily stores NEW in his memory without modifying the previous contents of memory. When GIVEN comes in, the hearer comes to know where he should store NEW and with what it should be associated, and (b) associates NEW with the proper information, and (c) thereby modifies the structure of knowledge in relation to NEW. If GIVEN precedes NEW, on the other hand, the hearer knows what to associate the next chunk of information (NEW) with in memory. When NEW comes

in, he (a) stores that information in the prepared slot and (b) modifies his knowledge structure accordingly. In this schema, the human storage system requires an extra storage space and an extra processing step when NEW precedes GIVEN in a sentence. Consequently, the GIVEN-NEW ordering is more favored than NEW-GIVEN ordering. The perceptual strategy associated with this tendency is what we will call Strategy 2:

Strategy 2: Store first-arriving information in a slot for GIVEN information and the next information in a slot for NEW information.

If Strategy 2 is correct, Rp is disadvantageous in terms of the efficiency of communication, because NEW precedes GIVEN in Rp and the hearer must restore in the correct slots the information previously stored in the wrong slots. Pc, on the other hand, does not require this extra effort, since this structure has the form GIVEN-NEW. Now the question is 'what is the case of Cl where a place-holder dummy pronoun it precedes NEW followed by GIVEN?'. It can be argued that it serves to signal the role that GIVEN information plays, namely to indicate that the following constituent carries NEW information and to instruct the hearer to store the information in a slot for NEW information. Therefore Cl is considered to preserve the GIVEN-NEW ordering.

Predictor C, number of consecutive NP's, has to do with Strategy 1, i.e., avoiding interruption or rearrangement of linguistic units. In simple basic sentences of English, no two NP's follow each other except for the indirect object and direct object. The more the number of consecutive NP's in a sentence, the less similar the sentence is to the basic structure. And in general the distance between a noun and the verb that agree in number and person tends to be greater as in (3):

(3) The soldier the president the student visited honored shot 73 birds.

As mentioned earlier, the greater the subject-verb separation, the greater the tendency that the sentence will not be adequately processed, possibly because of the short-term memory limitations. If there are too many consecutive NP's, the sentence will actually be incomprehensible or, at best, will be considered extremely unnatural. In such cases, Perceptual Strategy 1 may be used as an optional filtering device by the speaker or the hearer. Filtering is said to be optional in this case, because such sentences may or may not be comprehensible depending on the various conditions under which the sentences are spoken and heard, even though they are grammatical sentences in a formal sense.

Predictor D, number of instances of the same lexical item, seems at first glance to be related only to rhetorical and stylistic techniques. However, a sentence can sometimes be classified as ungrammatical even though close inspection suggests that it is grammatically acceptable but perceptually less favored. Akmajian's (1970) reflexive correction constitutes a good example. He noted that there is no obvious syntactic reason why sentences (7) and (10) should be bad while (8), (9), (11), and (12) are not.

(7) *It was me who cut me.

(8) It was you who cut me.

(9) It was him who cut me.

(10) *I am the one who cut me.

(11) You are the one who cut me.

(12) He is the one who cut me.

These sentences are not the cases where reflexivization ordinarily applies, because the two pronouns in each of the sentences are dominated by different S nodes in deep structure. Akmajian concluded that, "the repetition, or close succession, of identical personal pronoun is somehow unacceptable in surface structure". Akmajian also showed that a succession of identical personal pronouns is unacceptable even when the pronouns are at different levels of embedding: (13) and (14) are quite unacceptable while

(15) is more acceptable.

(13) ?It was me that John believed hit me.

(14) ?I am the one that John believed hit me.

(15) It was me that John believed hit myself.

Akmajian stated that he did not understand under what condition such reflexivization occurs, and he classified this kind of reflexivization as a low-level "correction" rule. He added that such solutions -- treating such a phenomenon as a low-level correction rule -- are in general not very attractive but there seemed to be good syntactic justification for positing such rules. The perceptual strategy underlying this phenomenon and Predictor D can be formulated as:

Strategy 3: Avoid repetition of identical lexical items.

The grammatical phenomenon which seems to be due to some rhetorical factors at first actually determines the grammaticality of the sentences. Strategy 3, then, can properly be alleged to serve as an obligatory filtering device which filters out some sentences as ungrammatical.

Predictor E, relative ordering of the subject noun and another noun, is related to the frequency of the ordering

of NP's in English sentences. Slobin (1973) argued that there is a tendency to preserve the internal or underlying structure of linguistic units in their surface manifestation and he discussed permuted and non-permuted ordering of elements. However, this kind of argument is not well-grounded in the sense that his assumption about the ordering of elements in the internal structure has never been tested and established empirically. But there is a useful point in his argument that there is a pressure to preserve an ordering of linguistic units regardless of what his characterization of the units may be. Bever (1970) pointed out that any NVN sequence in the surface structure is assumed to correspond directly to actor-action-object (agent-action-patient) in the internal structure and that this process of assigning semantic roles may reflect a statistical preponderance in actual utterances. A realization of Predictor E, the ordering of NPs-NPx which most likely amounts to agent-patient relation semantically, was more natural than the other realization NPx - NPs. This indicates that the judgments were dependent upon the tendency to look for the most frequent and common arrangement of linguistic units. Therefore Predictor E can be said to result from Strategy 1 to avoid rearrangement of linguistic items.

It has been shown that the five predictors are related to the three Perceptual Strategies 1, 2, and 3. This

means that the naturalness conditions in specific languages result from some general perceptual principles. Predictor A, C, and E are based on Strategy 1; Predictor B, on Strategy 2; and Predictor D, on Strategy 3. Considering the weights assigned to each of the predictors, Strategy 1 seems to be the most salient strategy that guided subjects' judgments of naturalness as far as the CLEFT constructions are concerned.

Further Research

It is quite conceivable that different languages show different naturalness conditions, since they are based not only on the universal perceptual strategies but also on the characteristics of each particular language. Given the perceptual strategies and the characteristics of a particular language, predictions can be made as to the naturalness of the sentences of the language. For example, Strategy 1 and any descriptive grammar of English together would predict that (16a) is less natural than (17a), while the same strategy and a descriptive grammar of Korean, which is a verb-final and left-branching language, would predict that (16b) is more natural than (17b). (16b) and (17b) express exactly the same idea as (16a) and

(17a) respectively.

(16a) [the soldier [the president [the student visited] honored] shot the birds]

(16b) [[[gu haksaing-i bangmunha-n] daitongryung-i
(the student-subj visit-adj president-subj

pyochangha-n] byungsa-ga sai-rul so-atta]
honor-adj soldier-subj bird-obj shoot-past)

(17a) [the soldier shot the birds [the student [the dog chased] freed]]

(17b) [gu byungsa-ga [[gu gai-ga chot-dun]
(the soldier-subj the dog-subj chase-adj

haksaing-i noaju-n] sai-rul so-atta]
student-subj freed-adj bird-obj shoot-past)

In these sentences the matrix sentence is always the same; the difference is in the position of the embedded sentences. In case of English, (16) has more material between the subject noun and the verb phrase of the matrix sentence than (17). In case of Korean, (16) does not have any intervening items in the matrix sentence while (17) has considerable material between the subject noun and object noun of the matrix sentence. In other words, the prediction is that English favors relativization on the object NP rather than on the subject NP while Korean prefers relativization on the subject NP rather than on the object NP. This prediction about English has previously

been made and tested against developmental data in English (Brown, 1971; Limber, 1973; Slobin and Welsh, 1973; Sheldon, 1974; Prideaux, unpublished). However, no such studies have been carried out for verb-final and/or left-branching languages such as Korean and Japanese.

Given the universal perceptual strategies and a descriptively adequate grammar of a language, it is possible to establish naturalness predictors of the language. It is important to test empirically these predictors and others which follow from the interaction of the strategies and specific syntactic properties of various languages. Such testing would either refute the strategies proposed in this thesis or, alternatively, would give them further support.

Summary

The work discussed in this thesis was stimulated by the existence of contradictory claims concerning CLEFT constructions. One claim, based on formal (Akmajian, 1970; Nakada, 1973; Harries, 1973; Culicover, 1977; etc) and behavioral (Hornby, 1971) data, states that the CLEFT constructions constitute a homogeneous family; and the other claim, based on behavioral data (Fletcher, 1973; Millar, 1976), states that they are heterogeneous in some unknown fashion. It was assumed that the homogeneity results from the functional or semantic properties of the three CLEFT types while the heterogeneity is due to syntactic characteristics rather than functional properties.

There are syntactic properties which may only function at an initial parsing of the sentence and which no longer play a role at a deeper level of processing. These syntactic features are viewed as functionally redundant or empty at that level. The assumption of the existence of non-functional syntactic properties at a certain level is the most important justification for the present work.

Experiment I was designed to investigate whether the

heterogeneity among CLEFT types is a function of differential naturalness associated with them and, if it turns out that it is, what syntactic properties are involved in determining the naturalness of the sentences. Since the results showed that the sentence types significantly differ in naturalness, the syntactic analysis of the twelve ST's in terms of surface generalizations was carried out to yield a set of five predictors of naturalness. The validity of the predictors was tested against a broad range of English sentences in two independent experiments to ensure that the predictors are not merely ad hoc statements relevant only to the CLEFT family. The predictors were found to be general enough to apply across a wide range of sentences. With this assurance, a multiple regression analysis was run on the five predictors in order to obtain the best fitting prediction equation of the naturalness, with a differential weight assigned to each predictor. The multiple regression analysis showed that the five predictors account for 97.7% of the total variation in the mean naturalness values of ST's resulting from Experiment I. Finally an attempt was made to explain perceptual basis underlying the predictors. Table 8 presents a summary of the conclusion drawn from the discussion of the results and perceptual relevance.

Table 8

Syntactic Determinants and Perceptual Strategies for Naturalness Judgments of CLEFT Construcions

Syntactic Determinants	Perceptual Strategy
A. Position of the embedded clause	1. Avoid interruption of linguistic units.
B. Relative ordering of clefted NP & copula	2. Store first-arriving information in a slot for GIVEN.
C. Number of consecutive NP's	1. Avoid interruption of linguistic units.
D. Number of instances of the same lexical item	3. Avoid repetition of identical items.
E. Relative ordering of NPs and NPx	1. Avoid interruption of linguistic units.

It was argued that predictions can be made as to the naturalness of certain, if not all, sentences of any language, given a descriptive grammar of the language and the universal perceptual strategies. As further research related to the present work, it was suggested that empirical test of the kinds of predictions based on the proposed perceptual strategies against verb-final and/or left-branching languages would be desirable in elaborating perceptual strategies associated with naturalness judgment or processing complexity.

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Appendix A

Instructions for Experiment I and Experiment III

Sentences vary along a continuum of naturalness. You may think that sentence (1) is a perfectly natural English sentence while sentences (2) is not as natural as (1) even though you can understand it fairly well.

(1) I want to go now.
(2) The criminal was brought by the police in.

The purpose of this experiment is to rate a list of sentences according to their degree of naturalness. We are interested in sentences as they appear in conversation. Please say each sentence to yourself so that you can base your rating on the impression of what is spoken instead of what is written.

Your rating will be made on a seven-point scale where '1' is the least natural end and '7' is the most natural end. Accordingly the rating '7' is supposed to be given to those sentences which you would use and easily understand given an appropriate situation. The rating '4', to the ones that you can easily understand but would not use in such a situation. The rating '1' is reserved for those sentences which are hard to understand and which you would never use in any context. The ratings in between will be done with reference to these criteria.

During the task, you should refer from time to time to the rating scale given in the square box. Remember that the low numbers are for the less natural sentences, and the high numbers for the more natural ones.

least natural most natural
1 - 2 - 3 - 4 - 5 - 6 - 7

Make your rating by putting a circle around the number

on the scale that best indicates your judgement of the degree of the naturalness of the sentence. The scale is provided directly under each sentence. Feel free to use the entire range of numbers, from 1 to 7; at the same time, don't be concerned about how often you use a particular number as long as it is your best judgement. Never refer back to what you have already done.

Now you will have five practice sentences which will give you some idea of how to perform the task.

(a) The basement was what the storm flooded.
1 - 2 - 3 - 4 - 5 - 6 - 7

(b) I feel like going out for a walk.
1 - 2 - 3 - 4 - 5 - 6 - 7

(c) By what the rabbit was watched was the hawk.
1 - 2 - 3 - 4 - 5 - 6 - 7

(d) That that martha was indisposed irritated John was obvious.
1 - 2 - 3 - 4 - 5 - 6 - 7

(e) It was the pitcher who scared the batter.
1 - 2 - 3 - 4 - 5 - 6 - 7

If you have any questions, please ask them now. If you are ready for the real task, please go on to the next page and begin.

Appendix B

Instructions for Experiment II

Sentences vary along a continuum of naturalness. You may think that sentence (1) is a perfectly natural English sentene while sentence (2) is not as natural as (1) even though you can understand it fairly well.

(1) I want to go now.
(2) The criminal was brought by the police in.

The purpose of this experiment is to rank sentences in a number of sets according to their degree of naturalness. More natural sentences may be thought of as those sentences which you would more likely use and more easily understand given an appropriate situation. Less natural ones are those which you would feel less inclined to use and/or hard to understand to a certain extent.

We are interested in sentences as they appear in conversation. Please say each sentence to yourself so that you can base your ranking on the spontaneous impression of what is spoken instead of what is written.

Compare the sentences in each set, determine the degree of naturalness relative to each other, and rank them by assigning '2' to the more natural sentence and '1' to the less natural sentence. Write down your rankings in parentheses following the sentences. Never refer back to any sets which you have already finished.

Now you will have three practice sets which will give you some idea of how to perform the task.

Set A
Girls who are in their teens are very sentimental. ( )
Teen-age girls are very sentimental. ( )

Set B
By what the rabbit was watched was the hawk. ( )
It was by the hawk that the rabbit was watched. ( )

Set C
That I say this to you is extremely difficult. ( )
It is extremely difficult that I say this to you. ( )

If you have any questions, please ask them now. If you are ready for the real task, please go on to the next page and begin.

Appendix C

Stimulus Sentences for Experiment I

Test Sentences

1. It was his disclosure that affected their attitudes.
2. What influenced his evaluation was her hints.
3. The girls were the ones who drank the coffee.
4. It was Henry that the coach consoled.
5. The one who the ambassador encouraged was the speaker.
6. That problem was what her discretion avoided.
7. It was the policeman who was attacked by the youth.
8. My brother was the one who was helped by the neighbor.
9. It was by bill that trevor was annoyed.
10. The ones by whom the politicians were criticized were the businessmen.
11. The principal was the one by whom the parents were summoned.
12. The one who pleased the manager was the driver.
13. It was the trainer who the detective saw.
14. What the experimenter watched was the flashlights.
15. It was the deer that was stalked by the wolf.
16. What was read by the teenagers were the comics.
17. The patient was the one who was bothered by the noise.
18. It was by the bullet that the vase was shattered.
19. It was this outcome that modified the theory.
20. What frustrated Mary was her carelessness.
21. His ability was what impressed the committee.
22. It was the alcohol that the nurse disliked.
23. The prosecuter was the one who the professor visited.
24. What was discarded by the secretary were the post cards.
25. The one by whom the rainbow trout was caught was his grandfather.
26. The captain was the one by whom the car was stolen.
27. It was the judge that condemned the officers.
28. Her father was the one who owned the hotel.
29. The one who the trucker punched was the wholesaler.
30. The gas station was what the lightening struck.
31. It was the wall that was scraped by the ladder.
32. What was found by the custodian was the class record.
33. The piano was what was chewed by the porcupine.
34. It was by the dolphin that the chairman was splashed.
35. The ones by whom the poet was admired were the radicals.
36. The butler was the one by whom the pipe was fixed.

Distractor sentences

1. John is considered to be incompetent by everyone in the lab.
2. The suit is too light to wear in this cold winter.
3. Music interests me very much.
4. The shooting of the hunters was terrible.
5. Mary played tennis.
6. I know the boy studying in the library.
7. Helen took Tom's coat off.
8. She fed biscuits to her dog.
9. The horse was kicked by the mule.
10. I called the man who wrote the book that you told me about up.
11. The soldiers the president the student visited honored shot 73 birds.
12. She feels fine today.

Appendix D

Stimulus Sentences for Experiment II and Experiment III

A10. That she is in Montreal with him surprises me.
A11. It surprises me that she is in Montreal with him.
A20. That he refused to come was impolite.
A21. It was impolite that he refused to come.
A30. That he had made a contract was disclosed.
A31. It was disclosed that he had made a contract.
A40. That that the sun is hot is important is true.
A41. It is true that it is important that the sun is hot.

B10. In the garden was where I found John.
B11. It was in the garden that I found John.
B20. In the middle of the concert was when Henry began coughing.
B21. It was in the middle of the concert that Henry began coughing.
B30. By standing on a ladder was how John did it.
B31. It was by standing on a ladder that John did it.
B40. To bake a cake for Mary was what John did yesterday afternoon.
B41. It was to bake a cake for Mary that John did yesterday afternoon.

C10. I know the boy whose parents the principal summoned.
C11. I know the boy whose parents were summoned by the principal.
C20. They visited the lawyer whose house our professor designed.
C21. They visited the lawyer whose house was designed by our professor.
C30. We stayed in the hotel whose owner Mr. Johnson accused.
C31. We stayed in the hotel whose owner was accused by Mr. Johnson.
C40. I threw away the teapot whose lid the boy broke.
C41. I threw away the teapot whose lid was broken by the boy.

D10. This is the book that is very interesting to me.
D11. This is the book that interests me very much.
D20. She has just bought the book that george has already read.
D21. She has just bought the book that george wants to read.
D30. That house is bigger than ours is.
D31. That house is bigger than ours.
D40. This is the kind of problem that he is able to handle.
D41. This is the kind of problem that he can handle.

E10. In the office Mary was crying.
E11. Mary was crying in the office.
E20. At the report the premier was surprised.
E21. The premier was surprised at the report.
E30. To the manager my teacher was talking.
E31. My teacher was talking to the manager.
E40. By the custodian the class-record was found.
E41. The class-record was found by the custodian.

Appendix E

Comparison of Observed Means and Predicted Means

SEQNUM	OBSERVED MEAN	PREDICTED MEAN	RESIDUAL
1	5.722219	5.838733	-0.1165140
2	5.740740	5.537806	0.2029337
3	4.870370	4.934413	-0.6404346E-01
4	4.824070	4.729935	0.9413511E-01
5	4.750000	4.639660	0.1103391
6	4.611110	4.633486	-0.2237626E-01
7	4.148149	4.202159	-0.5401007E-01
8	4.101850	4.338733	-0.2368839
9	3.805559	3.735340	0.7021832E-01
10	3.731480	3.825614	-0.9413511E-01
11	3.490740	3.434414	0.5632643E-01
12	3.351850	3.297839	0.5401007E-01

Appendix E (continued)

Plot: Standardized Residual (down)
Predicted Standardized Dependent Variable (across)